APRIL 1949

Plant Engineering

IN THIS ISSUE

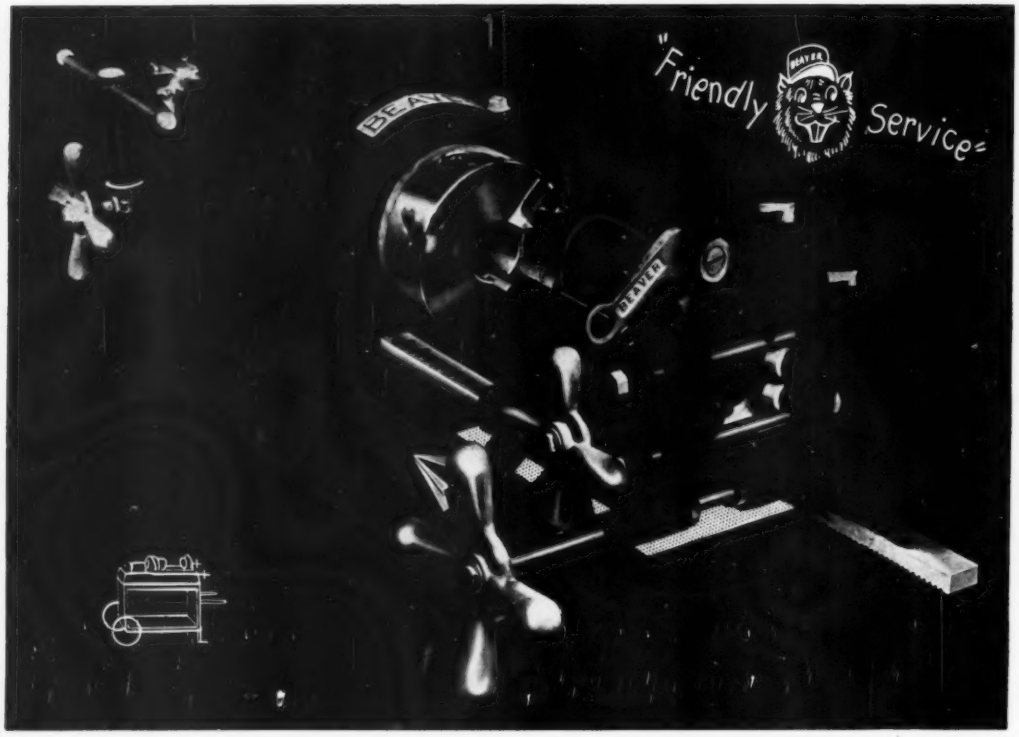
Plangineering 27
Heat Exchanger Costs, Selection and Maintenance. *By A. Levine* 28
Of Course, MH is Plant Engineering's Job. *By Herman A. Scharf* 31
Adhesives, Coatings, Sealers—Their Application in the Plant 32
By J. E. Gill
Fight for Lower Freight Rate on Empty Pallets Gains Impetus 35
By Richard H. Morris
Preventive Maintenance Program—Electric Storage Batteries 36
By K. A. Vaughan
Selection, Use and Care of Tools. *By Thomas Trail* 39
Color and the Cash Value of Accidents. *By Faber Birren* 40
The Vacuum Pump—Its Cost and Use for Industrial Processing 42
By Noel R. Maleady
Washing 1,000,000 Horses 44
Safety Crimes—Not Here! 45

REGULAR DEPARTMENTS

'Round About with the Editors 4
Plant Engineers' Digest—*From Sawdust Into Gold . . . Electrical Code Requirements Change Needs . . . Tooling Trick Raises Tool Life . . . Gas Safety Control Cock . . . Hydraulic Tree Puller . . . Switch Turns Oil Off . . . Stethoscope for Bearings* . . . 8
New Products and Methods 16
Questions and Answers 48
Maintenance and Operation 51
Bulletins . . . Catalogs 56
Plant Engineers' Library 68

Volume 3, No. 4

The magazine that helps plant engineers with their everyday problems



The BEAVER MODEL-B...now redesigned with many new improvements added!

● During the past 10 years, the BEAVER MODEL-B has won the warm respect of thousands of owners through its unfailing, trouble-free performance. So that you may better understand the class of such owners, it is fitting to tell you that "DuPont" used 75 BEAVER MODEL-B's on a single job; a number of plumbing and heating contractors own more than 50 each; many industrial plants and railroads have from 10 to 40.

After ten years' experience with a product it is natural that ways and means are discovered to make further improvements. Therefore, we are starting the Model-B off on its second "decade" with a complete redesign which includes a streamlined aluminum housing; an automatic switch lock which makes it impossible to start the motor if the operator forgets to remove the chuck wrench from the chuck; an outboard eccentric spool steady-rest—which prevents the "whip" of long lengths of overhanging revolving pipe from "rocking" the spindle, causing premature wear of bearings and, worst of all, flat-sided threads which are likely to leak.

You will like the Beaver Model-B—it is an excellent "utility" machine!

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ECCENTRIC SPOOL PIPE STEADY-REST stops the "whip" of long lengths of revolving pipe from rocking the spindle and causing "flat-sided" threads.

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Choice of knife or wheel cutoff of superior patented design.

Standard heavy-duty universal 3-jaw chuck.

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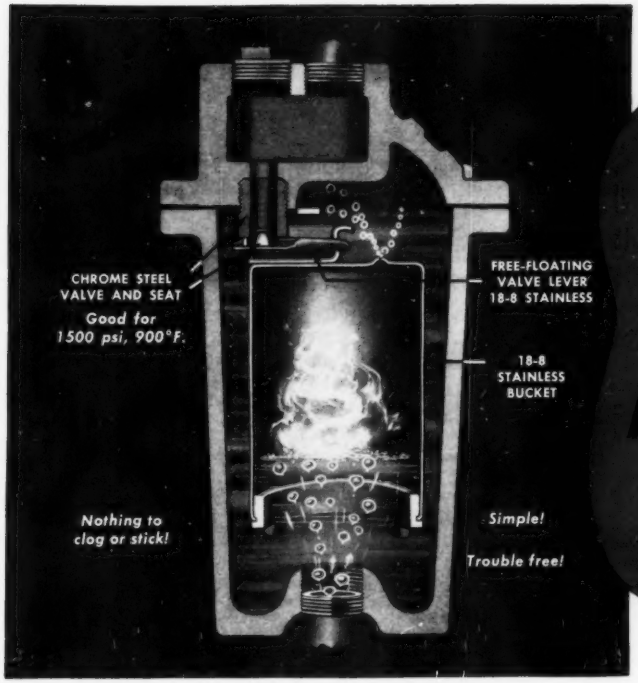
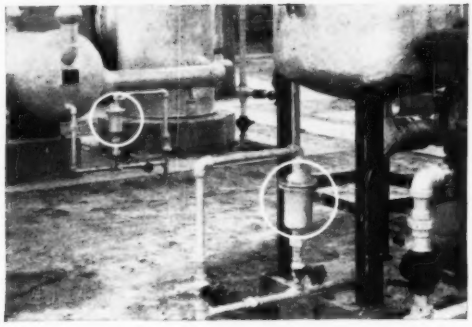


it isn't the cost or the upkeep with ARMSTRONG STEAM TRAPS



IF the first cost of Armstrong Steam Traps was high, which it isn't, they would still be a good buy because of low upkeep.* Maintenance on Armstrong Steam Traps is exceptionally low because:

1. Even in Armstrong Steam Traps for low and medium pressures, the valve and seat are chrome steel, hardened, ground and lapped to leak-tight fit —identical in materials and workmanship to those used in Armstrong traps for pressures to 1500 psi, 900°F.

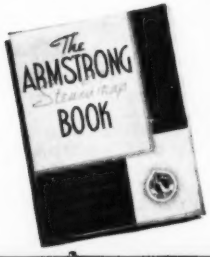
2. The Armstrong free-floating valve lever mechanism is unusually resistant to wear because there is no friction and it is of heavy corrosion-resistant stainless construction.

3. Dirt is washed through the trap by the swirling action of the condensate—and out through the nice big valve orifice.

4. There is nothing to clog, stick, bind or collapse.

Add up these features and you arrive at a trap that very seldom needs maintenance—a trap that saves man hours and money—a trap that pleases everybody from the purchasing agent to the pipe fitter.

THE 36-page ARMSTRONG STEAM TRAP BOOK tells all about these traps, how to select and install them for long, trouble-free performance. Send for your copy.



*You get more hot condensate capacity with Armstrong Steam Traps per dollar of investment than with any others.

P.S. Because they don't leak steam, Armstrong Traps are excellent for saving fuel.

Send for the Steam Trap Book!

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Published Monthly by

TECHNICAL PUBLISHING CO.
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CHICAGO 4, ILL.

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Subscription Information—Published Monthly. Prices: United States and Possessions one year $10.00, Canada one year $11.00. Other countries one year $12.00. Single copies $1.00.

'Round About with the Editors

Putting Corrosion To Work

To A TRUE scientist every material has a potential use—even rust. About three years ago Westinghouse materials engineers began to look around for some means of putting iron oxides to work. Since it was a good electrical insulator, it might well have possibilities as insulation between the iron laminations of generators and motors. Iron oxide coatings were found to be satisfactory, but considerable difficulty was encountered in obtaining uniformity.

Recently materials engineers discovered the reason—the coatings were not of the same iron composition even though no difference was apparent to the naked eye. Being of different composition, the oxide coatings naturally had different resistances. The reason for the non-uniformity was due to the temperature at which the oxide was formed. Oxides formed above 570 C have low resistance, since FeO is formed at this temperature and subsequently decomposes into free iron and Fe_3O_4. The lack of uniformity was overcome by a new process of steam oxidation, one in which the annealing and oxidation procedures were combined. The electrical sheet steel was placed in a heat-treating furnace, annealed in the proper atmosphere, then brought down below 570 C for the steam oxidation.

Company School Co-Op Program

Contributed by George N. Janes

AN EXCELLENT example of cooperation between local public schools and local industries exists in our community. Henry L. Rosse, Coordinator of Vocational Education at Eddystone High School, officials and engineers of several of the large companies in the vicinity must be credited with the success of the educational plan.

Students for the various courses are enrolled from these local industries after having passed a rather rigid apprenticeship examination. Studies open to the apprentices include plumbing, electrical work, pattern making, machining, pipe fitting, tool and die making, hammersmithing, boiler making, molding and core-making. Practical aspects of each job are taught during the apprentices' regular work day while, for three afternoons a week for a total of 150 hr. the student must study at the high school.

School work consists of a study of mathematics relating to the particular trade in which he is apprenticed, mechanical drawing and theory. A total of 155 apprentices are, at the present time, taking advantage of this combined work-learn program.

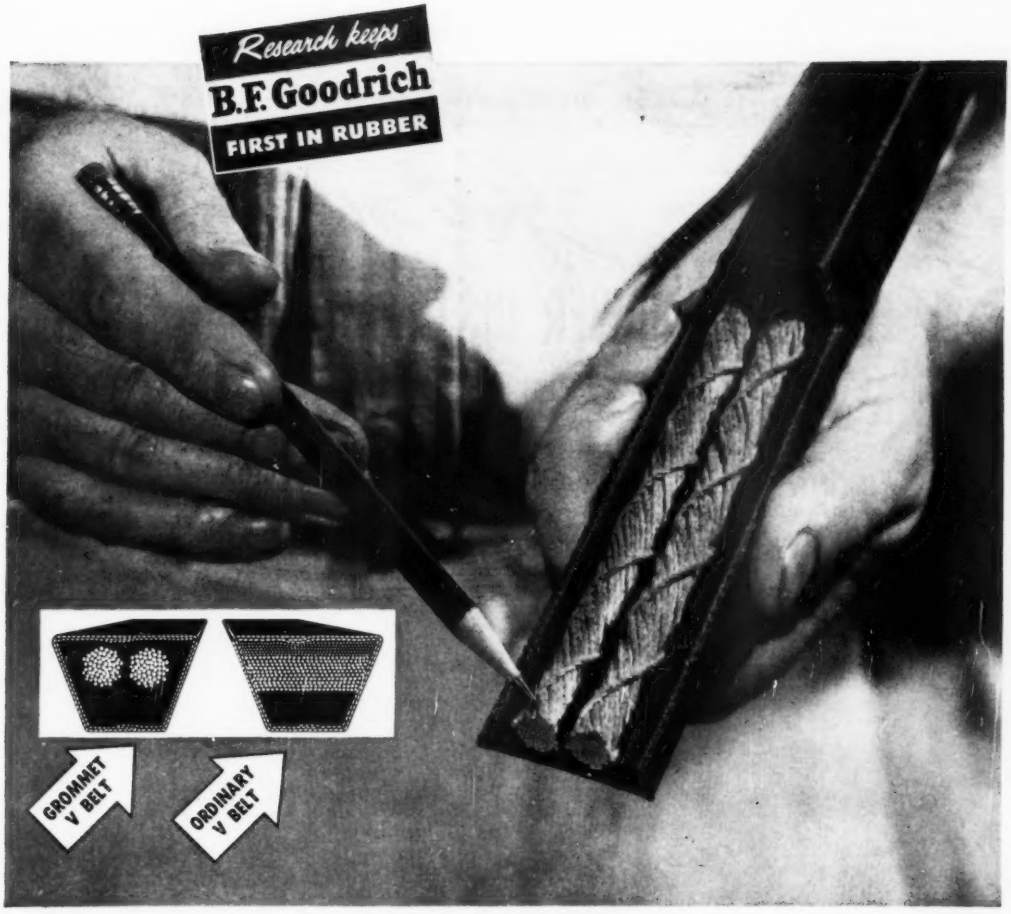
He Didn't Do It—

NOT SO LONG ago a farmer was leaning against a fence chewing a straw. A farm book solicitor approached him and said, "Wouldn't you like to subscribe for this publication, FARM EFFICIENCY? It will teach you how to do a better job of farming and in that way you will make more money."

"Naw," drawled the farmer, "I ain't doin' near as good as I know how to do now."

In other words, the farmer was lazy, and he just wasn't interested in doing a better farming job. The same is true to a large extent of many of us. We know how to do many things better, but we don't. Doing better requires effort, and as long as we can get by, we are inclined to let things slide. We follow the line of least resistance. That is bad. To get out of the rut try writing up the better way and share the idea with others. In this way you avoid the physical labor at least for the time being. Eventually you get so wrapped up in helping the other fellow that you are working like a beaver—or an editor!

Plant Engineering is published monthly at 53 W. Jackson Blvd., Chicago 4, Ill. Subscription price $10.00 per year to U. S. A. $11.00 to Canada. $12.00 to other countries. Single copy $1.00. Application is pending for acceptance under Act of June 5, 1934.



This V belt will cut your belt costs 20% to 50%

Only B. F. Goodrich makes the grommet belt—there's no other like it

THE B. F. Goodrich patented grommet belt lasts 20 to 50 per cent longer but costs no more than an ordinary V belt.

A grommet is *not a cable.* It is made by winding heavy cord *on itself* in an endless loop. (Cables are simply twisted cords; ends must be overlapped or spliced.)

Better than multiple cords. In a grommet belt all the cords work *all the time.* There are no cords in the *center* of the belt — which in an ordinary belt don't pull their share of the load.

More flexible. There is no splice, no stiff section where cords overlap. (85% of failures of ordinary belts occur in overlapped sections.) BFG belts have twin grommets, no fabric or plies in the middle of the belt that stiffen it and generate heat.

Stand shocks. Grommet belts run cooler, are stronger, have more *elasticity* but less *permanent* stretch than any other kind of belt. They stand sudden shock. Both laboratory and field tests have proved that they outlast all others, especially on hard drives.

Large sizes only. At present grommet belts are made only in largest sizes (D and E sections). Later, other sizes may be made.

More information. If you buy or use large-size V belts, don't do without the advantages grommet belts can give you. Talk to your BFG distributor. Or write, if you wish, for leaflet 2170. Address Dept. L-10, *The B.F.Goodrich Company, Industrial Products Division, Akron, Ohio.*

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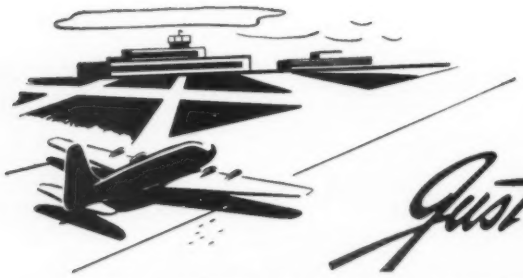
RUBBER FOR INDUSTRY

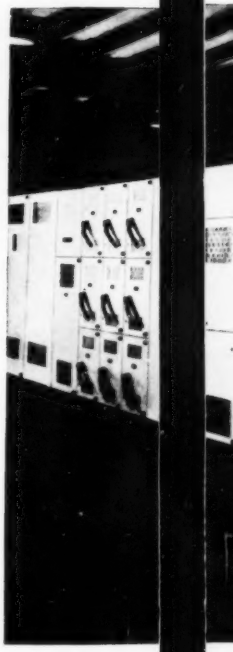


Just an example

BUT...IT'S POWER DISTRIBUTION AT ITS BEST!

. . . just a Dry-Type Power Center installed in a large eastern airport. The thousands of people who land and take off never see it. Yet, their very lives depend on it *and* the Power Distribution System of which it is a part.

These modern Dry-Type Power Centers are a part of the Spot Network System equipped by Westinghouse . . . a system chosen because reliability of service was of the utmost importance. Every vital operation of the airport depends on this reliability . . . from ground control approach equipment to crash and fire alarm system.



Modern Dry-Type Power Centers were chosen to assure Reliable and Economical distribution of power...

and here's why...

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- Costly vaults eliminated
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- No maintenance of gaskets, valves and level gauges
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- Separate breaker compartments
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- Draw-out circuit breakers quickly inspected
- All parts readily accessible
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- Installed as a unit
- "Unitized" design saves valuable floor space
- Factory assembled and tested . . . as a *unit*
- Undivided responsibility for manufacture and correct functioning of all equipment

Modern Westinghouse Dry-Type Power Centers can be supplied for use in any distribution system, whether radial or network . . . where the high voltage is 15 kv and below. CONSULT WESTINGHOUSE. Call your nearest Westinghouse office or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.

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Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Yes... Every Industry's Problems ARE Different!

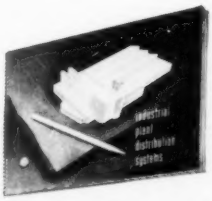
Nothing is more vital to industry than the Power Distribution Systems that provide the power for its machines. Thus, it is most important that the *best system* be selected and included in the basic planning for expansion or new building.

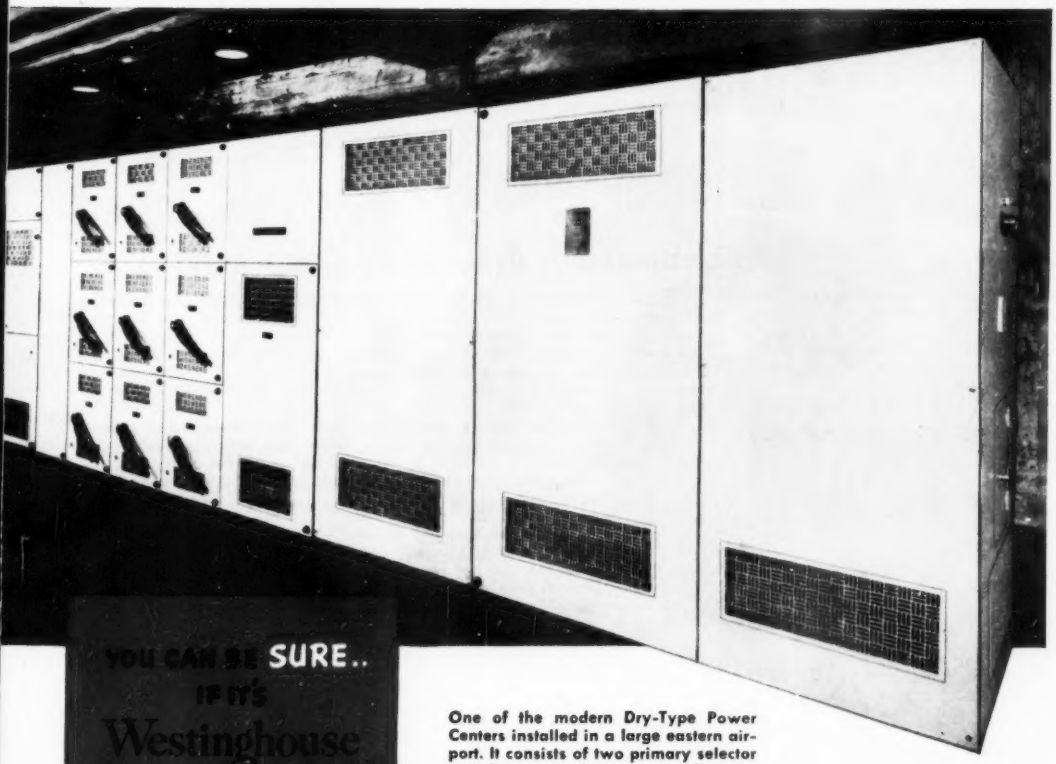
These problems vary greatly from industry to industry . . . from plant to plant. Meeting these problems for widely diversified industries has given Westinghouse an intimate knowledge of fields that undoubtedly closely touch *your* problems.

We can help *you* find *your* answer. New ways of distributing power to economically provide better voltage regulation, greater reliability, greater safety . . . these are a few of the problems for which our engineers have found new and better solutions.

★ ★ ★

Write for the new booklet *"Industrial Plant Distribution Systems"*. You'll find the fact-filled pages invaluable in choosing a power distribution system that best meets *your* requirements. Ask for B-4045.





YOU CAN BE SURE..
IF IT'S
Westinghouse

One of the modern Dry-Type Power Centers installed in a large eastern airport. It consists of two primary selector switches, two dry-type transformers, two network protectors and low-voltage circuit breakers.

MODERN EQUIPMENT FOR MODERN DISTRIBUTION SYSTEMS

Plant Engineer's Digest

From Sawdust Into Gold

MAN HAS WASTED pyramids of sawdust since he first learned the art of turning sawlogs into lumber. As forest margins shrink and lumber piles drop lower, farseeing lumbermen look speculatively at their sawdust mounds. For lumber constructed from woodwaste has long represented a tantalizing quest to lumbermen. True to the adage, however, our lumber necessities are at last mothering invention. One of the most recent of these developments is Prespine, announced a few months ago by Curtis Companies, Inc., Clinton, Iowa. This "synthetic" wood panel, made from woodwaste and resin, successfully opens a path to a previously untapped lumber source.

Prespine is panel made almost entirely from sawdust, from finely divided wood rejected for its knots or other imperfections, trimmings, all materials which have little other use than firing a mill's boilers. Strong, even-textured, it is held together by a synthetic resin, phenol formaldehyde. From the trimmers, saws and doweling machines, a steady flow of unwanted wood formerly went only to the power house furnaces, the fine materials went directly, the chunks and lengths via a hogging machine which broke them up into coarse sawdust.

A sizable portion of this conglomerate waste now is sucked in pipes to the Prespine plant where it is ground to still smaller size by the action of a hammer mill. After a thorough mixing with a bonding agent, called Resinox, the yellow sawdust mix is next fed by a specially built machine into square trays, four feet on a side. From the feeder, the trays are slipped into a hot press similar to that in common use in plywood making. The wood-resin mixture, slightly more than an inch deep, is compressed under heat and high pressure to one-quarter inch thickness.

Prespine is made into door and kitchen cabinet units by Curtis Companies, Inc. They find very few changes necessary in normal production; the Prespine cuts, trims and sands as easily as regular lumber

Smooth and even-textured, these Prespine panels require only a minimum of sanding and edge trimming. From then on they are handled as though they were normal lumber. They can be sawed, planed and nailed just as easily. But in several respects, Prespine goes wood one better. Paint is said to adhere more smoothly, no grain lines mar the smooth surface. Better still, it is said to have ten times more resistance to denting than natural wood panels.

It requires no special knowledge to translate this tougher quality into fewer gouges and scars in doors and cabinets—scars that are normally acquired from everyday use. This product's long range future is exciting the lumber and plastic industry. Here is a "synthetic" wooden panel, equal to and, in many respects, better than natural wood. What will be the shape of the milling industry when its hundreds of sand dune-like piles of sawdust find more profitable, useful employment?

Suggested immediately are additional boards which are wider, which can be molded like plastics, which with varying resin content might have amazing strength and surface toughness. Counter tops, intricate architectural moldings, subflooring, wall paneling, countless uses suggest themselves. So well-founded economically is the sawdust resin panel that regardless of lumber's availability now or later the manufacture of this newest material should expand. *From December 1948 issue of Monsanto Magazine, a publication of Monsanto Chemical Co., St. Louis, Mo.*

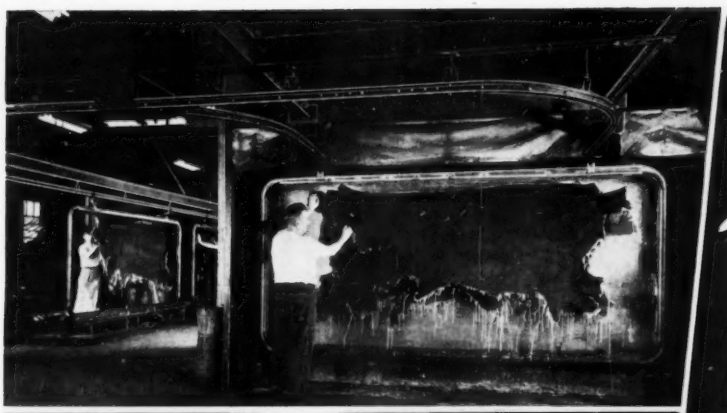
Electrical Code Requirements Change Needs

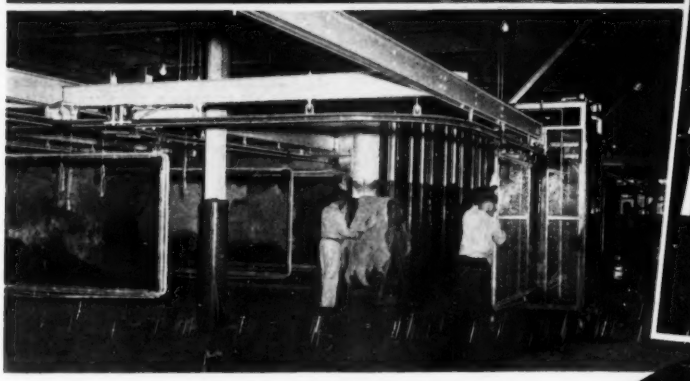
NATIONAL ELECTRICAL CODE requirements are much more strict today than they were twenty years ago when the trend toward electrification of many plants got well underway. Consequently the electrical distribution systems of some plants do not meet present-day code standards of safety and efficiency.

Take the hypothetical case of a 200-hp, 3-ph, 440-v motor driving a Jordan in a paper mill and having a full load rating of about 240 amp. Twenty years ago a cable running in conduit to this motor would have had a current rating of 110 per cent of the nameplate ampere rating of the motor, or roughly 265 amp. In 1927 the code stated that a 300 mcm cable was good for 275 amp so a cable of that size would have been used. Today the same motor would require a 500 mcm cable. Many other examples could be quoted.

This does not mean that all cables installed in the last two or three decades will probably fail but it does mean that many now in use are carrying a load far greater even than that at which new cable of the same size is rated. Added to this is the fact that considerable expansion has been made in the electrical distribution systems since their installation and that much new equipment has been connected to existing circuits. Fig. 2 shows sections of a No. 1/0 Type R cable which had been in service nineteen years. The small sections of rubber insulation at lower center were broken off merely by pinching the cable with the fingers. All semblance of flexibility has been lost and the material is practically worthless as an insulating medium. Furthermore, the present code calls for at least a 250 mcm Type R or a No. 3/0 varnished, cambric, Type V cable for the particular

Fig. 1. This close-up of damage to an alternator stator shows clearly the necessity of restacking lamination iron in addition to rewinding the unit





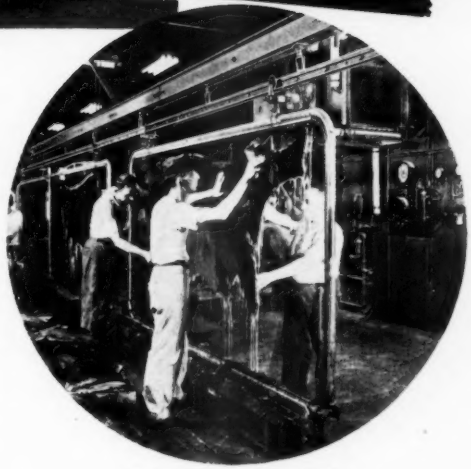
Faster Drying with AMERICAN MONORAIL

Here's a simple MonoRail loop with carriers and "kicker" switches that really speeds up leather drying.

Sides or skins are pasted on glass plates in carrier frames suspended from a MonoRail track; all unnecessary manual handling is eliminated. After the wet leather is pasted on glass, the carrier moves through the dryer without rehandling and the dried leather is stripped from the glass plate for further processing.

An automatic switch transfers the carrier from single to double line travel through the dryer. After the leather has been removed, the carrier is automatically transferred from double to single line travel through the plate washer and pasting stations.

This is just another example of the simplicity of MonoRail application that most economically correlates transfer and processing operations. An American MonoRail engineer can show you how you can increase production and lower costs with American MonoRail Overhead Handling.



Photographs through courtesy of Proctor and Schwartz, Inc.

THE AMERICAN MONORAIL COMPANY

13123 ATHENS AVENUE **CLEVELAND 7, OHIO**

Fig. 2. This cable insulation had been in service for 19 years. Its value as an insulating medium was negligible since it had been exposed to excessive temperature and overloads

service from which this No. 1/0 was taken.

A great many electrical failures are due to fatigue of the conductor and deterioration of the insulating material. One prominent manifestation of fatigue is the failure of disconnect and terminal studs. Failures of this kind are not always recognized as fatigue, however, because when the fault occurs the material at the point of failure is usually consumed by the resulting arc and all evidence of fatigue is obliterated.

Due to exposure and type of operation in some plants, twenty years is generally considered to be the safe useful life of a motor winding although much depends upon the particular application.

Take the case of one paper mill that had several direct-current, variable-speed line shaft drives of the type that was generally installed eighteen or twenty years ago. About two years ago several of the voltage regulator and relay coils of the motor-generator control failed due to deterioration of insulation. The failures were not in themselves serious, but in each case from two to three hours production was lost while the coils were being replaced. It is considered advisable to check and tabulate the internal resistance of all such coils at regular intervals and when any decrease in resistance is noted, indicating shorted turns, they should be replaced.

The effects of old age are also apparent in the fields of turbo-generators. Internal resistance of field windings should be tested at each dismantled inspection for high resistance connections which frequently develop at the collector rings in old fields. These are relatively easy to correct, but if they are allowed to remain they may cause over-heating and eventual failure. A low resistance value would indicate shorted turns which could cause an uneven field strength and possibly a mechanical vibration within the machine. The manufacturer of the machine can provide the value of the original resistance if he is furnished with the field serial number.

It is extremely important that old equipment in particular receive careful maintenance and periodic inspection. If records of field Megger readings on old machines are kept, deteriorated and carbonized insulation will often be indicated by low insulation resistance readings. Any low resistance reading should be investigated thoroughly and every effort made to raise it at least one megohm before the machine is again placed in service. *From the January 1949 issue of the Condenser, a publication of the Mutual Boiler Insurance Company, Boston, Mass.*

Tooling Trick Raises Tool Life

THERE IS nothing new about hard die inserts as a means of extending die life, except perhaps the application of this proved principle. The problem, which faced Oliver Iron and Steel Corp. was one in the production of a high carbon U-bolt. This bolt is made from a straight piece, threaded on both ends and then cold formed into a U by bending it around a die of proper radius. Figure 1 shows the original die set-up consisting of a lengthy mandrel of 0.95 per cent carbon steel, forged, hardened and ground to a size that would produce the desired inside radius in the U-bolt.

Working with this mandrel die were two traveling saddle dies made of the same grade of steel, but with a groove in each side which would secure the piece and bend it around the mandrel die with an upward movement. The pressure and wear of bending 0.35 to 0.45 per cent carbon steel 5/8 in. diameter would deform these dies beyond tolerance limits, which occurred in the mandrel die after about 7000 pieces and in the saddle dies after about 12,000 pieces. Replacement entailed entirely new or refinished dies which were relatively costly and required considerable installation time. Shown in Fig. 2 is the die set-up as revised to take die inserts of hardened tool steel. A similar mandrel is used to hold the insert so that the working pressures are still absorbed by the mandrel; the insert is merely held in place by a cap screw.

The traveling saddle dies have been transformed to include inserts of hardened tool steel which have the required grooves in both sides. Since the work pressures of bending affect only the upper end of the groove, each insert can be turned end-for-end and later turned over

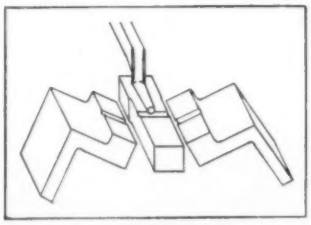


Fig. 1. The die set-up originally used consisted of solid pieces as shown in this drawing

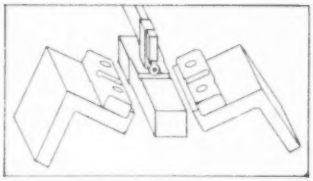


Fig. 2. Revising the die set-up so as to use inserts of hard tool steel made it possible to replace the worn portion of the tool. In addition, the inserts could be used several times by turning end-for-end, or by turning them over

and used on the other side so that four individual die surfaces are presented by each insert before complete removal is required.

Die life, as a result of die insert on the mandrel, has climbed from about 7000 pieces to better than 35,000 pieces, or more than 500 per cent. On the saddle dies, as a result of the insets, die life has increased from about 12,000 pieces to better than 75,000 pieces, or more than 600 per cent. Downtime for replacing worn die parts has decreased about 75 per cent for the mandrel and about 20 per cent for the two saddles. Die costs per unit has been reduced to approximately 70 per cent. *By Frederick Lovell, Oliver Iron and Steel Corp., in Fasteners, a publication of the American Institute of Bolt-Nut and Rivet Mfrs., Cleveland, Ohio.*

Gas Safety Control Cock

A NEW AND POSITIVE method of preventing fuel explosions in multi-burner, gas fired industrial furnaces, ovens, dryers and boilers has been developed by Factory Mutual Laboratories.

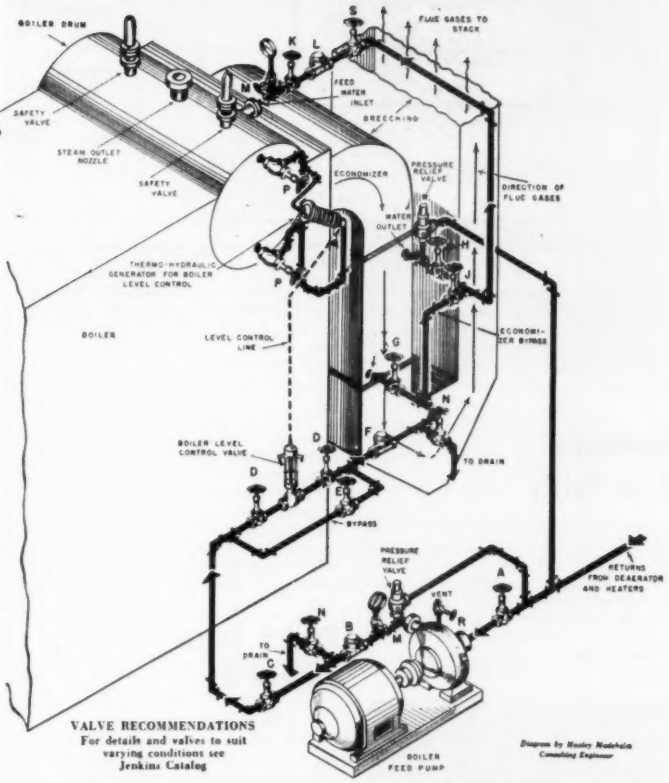
The type of explosions prevented are those which may result if a burner cock is accidentally left open when the main gas supply is turned on, and if there is then any delay in applying the lighting torch. Such an interval would permit an explosive gas-air mixture to form which would be ignited when the torch is applied.

The new method assures that all burner cocks will be closed before the main gas supply can be turned

Jenkins PRACTICAL PIPING LAYOUTS 40

How to plan

BOILER ECONOMIZER PIPING



This economizer hookup contributes considerably to high boiler operating efficiency and reduces fuel costs by bringing the water as near to boiler temperature and pressure as possible before it enters the boiler. This is accomplished by extracting heat from exhaust gases with an economizer.

Water feed is controlled by any of the various types of boiler level controls. The one shown is a thermo-hydraulic generator in which the water column serves as the generator. A change in the boiler water level changes the temperature and the fluid pressure in the outer tube and operates the control valve hydraulically.

The more efficient counterflow heat transfer, used in this economizer, is preferred to the parallel flow type wherever installation is possible. Pressure relief valves are required on the economizer outlet, and a by-pass allows the boiler to be operated even though some of the tubes fail.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation. Copies of Layout No. 40, enlarged, with additional information, will be sent on request. Just mail the coupon.

A CHOICE OF OVER 500 VALVES

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering experience, select all the valves you need from the Jenkins Catalog. It's your best assurance of *lowest cost in the long run.*

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Since Jenkins Bros. 1864

VALVE RECOMMENDATIONS
For details and valves to suit varying conditions see Jenkins Catalog

Jenkins Valves				
Code	Quan.	ASME Rat. To 160#	ASME Rat. 160#-240#	Service
A	1	Fig. 270-U	Fig. 280 Bronze Gate	Boiler Feed Pump Suction
B	1	Fig. 762	Fig. 962 Bronze Swing Check	Pump Discharge—Prevent Backflow
C	1	Fig. 950	Fig. 970 Bronze Globe	Pump Discharge Shutoff
D	2	Fig. 270-U	Fig. 280 Bronze Gate	Level Control Valve Shutoff
E	1	Fig. 950	Fig. 970 Bronze Globe	Manual Bypass of Level Control Valve
F	1	Fig. 762	Fig. 962 Bronze Swing Check	Prevent Backflow
G	1	Fig. 270-U	Fig. 280 Bronze Gate	Economizer Water Inlet Shutoff
H	1	Fig. 270-U	Fig. 280 Bronze Gate	Economizer Water Outlet Shutoff
J	1	Fig. 270-U	Fig. 280 Bronze Gate	Economizer Bypass
K	1	Fig. 270-U	Fig. 280 Bronze Gate	Boiler Feed Water Piping to Boiler
L	1	Fig. 762	Fig. 962 Bronze Swing Check	Prevent Backflow from Boiler
M	2	Fig. 743-G	Fig. 705 Bronze Needle	Pressure Gage Control
N	2	Fig. 950	Fig. 970 Bronze Globe	Drain Valves
P	2	Fig. 952	Fig. 972 Bronze Angle	Taps to Boiler Drum for Level Control
R	1	Fig. 743-G	Fig. 705 Bronze Needle	Pump Vent
S	1	Fig. 950	Fig. 970 Bronze Globe	Boiler Feed to Boiler Drum

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For every Industrial, Engineering, Marine, Plumbing-Heating Service . . . in Bronze, Iron, Cast Steel, and Corrosion-resisting Alloys . . . 125 to 600 lbs. pressure.

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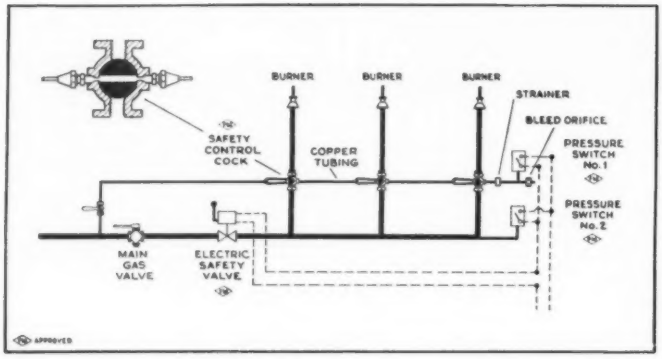


Gas cocks on each burner control a pressure switch which in turn controls the electric valve

on. A new type of safety control cock has been developed and is now commercially available which replaces other burner cocks. The cock has side ports; and the side ports of all cocks are connected with copper tubing. One end of the line of tubing is connected to the main gas line on the supply side—the other to a pressure switch.

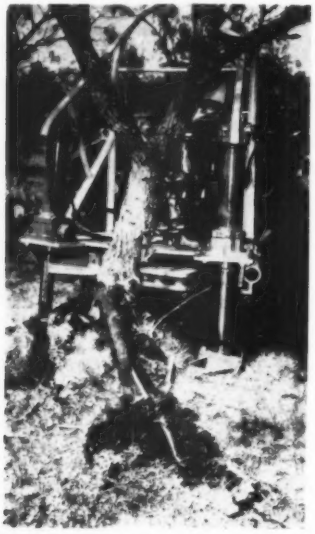
In "lighting-off," or starting the furnace, the operator first turns the gas into the small line connecting the cock side ports. If the cocks are fully closed as they should be, gas flows through them by way of the side ports and operates the pressure switch. This in turn energizes the electric valve on the main gas line, so the operator can open it; this must be done by hand.

If one of the cocks happens to be even partly open, the pressure switch will not operate and the electric valve cannot be opened.

The system is adaptable to any type of burner and its air-gas mixing equipment. Combustion air, where available, is preferable to gas for use in the safety system. Protection is provided against failure of combustion air or gas pressure, while firing. Other advantages, such as simplicity and reliability, also recommend the system for use in important installations. *From the December issue of Factory Mutual Record, a publication of Associated Factory Mutual Fire Insurance Companies.*

Hydraulic Tree Puller

WHAT IS HOPED will prove to be particularly effective against one of the scourges of the Southwest, the mesquite, is a recently developed hydraulic tree puller. This puller can be attached to a farm tractor for locomotion. Useful in clearing land of any types of trees up to 11 in. in diameter it was developed particularly to rid the Southwest of the mesquite tree which casts no shade and provides no forage for cattle, grows rampantly, and unless removed, roots and all, will spring up again at various points. *From February 1949 issue of Ethyl News, a publication of Ethyl Corporation, 405 Lexington Avenue, New York 17, New York.*

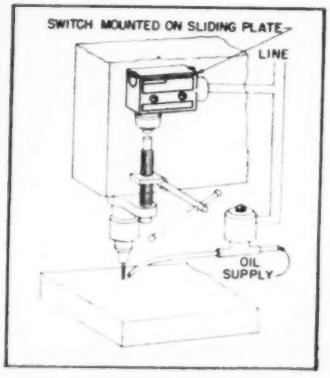


This hydraulic tree puller can uproot trees up to 11 in. in diameter; it was developed by the Southwest Research Institute

Switch Turns Oil Off and On

I HAVE USED snap-action in the tooling up of a new plant in many ways. One of the many uses which may prove helpful for any finishing plant is illustrated in the accompanying drawing. Oil is supplied from oil pumps to the drills, as illustrated, and taps on the machines and it was very messy when the oil was left to run by gravity. I mounted a snap-action switch above the adjustable stop on the drill and tapping heads.

As the drill is moved down, the normally closed side of the switch operates a small solenoid valve and allows the oil to flow onto the work. When the drill returns, it opens the circuit shutting off the oil. *By Ernest C. Ike, Plant Electrician, Western Die Casting Co., Emeryville, Calif., in Micro Tips, a publication of Micro Switch.*



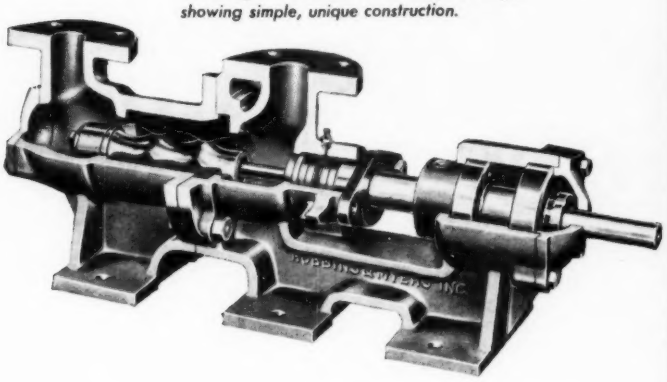
Here is a switch that saved oil, cleaned up a mess

Stethoscope for Bearings

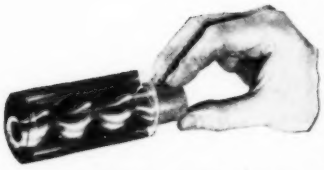
A maintenance tool can easily be made which can be used for determining what goes on inside a ball bearing. With a little experience, is easy to use and evaluate the results. The only items required are a piece of fiber rod $\frac{3}{8}$ in. in diameter and 20 in. long, threaded at one end for $\frac{1}{2}$ in. with a standard $\frac{3}{8}$ in. thread cutting die, and an old telephone receiver shell with a $\frac{3}{8}$ in. tapped hole in the small end. If the old telephone receiver is not available, obtain a fiber or micarta tube $1\frac{1}{2}$ in. in diameter and 6 to 8 in. long. Turn a hard wood block to fit one end and drill and tap this block for the $\frac{3}{8}$ in. fiber rod.

In operation, the end of the fiber rod is placed against the bearing housing and the ear is placed against the open end of the receiver or tube. After a short time the operator becomes proficient in distinguishing between the noises that mean trouble and those that denote normal performance. A steady hum indicates that the bearing is O.K. *From Vol. XIV, No. 2 issue of "Maintenance News," a publication of Westinghouse Elec. Corp.*

Cut-away of Standard R & M Moyno Pump; showing simple, unique construction.



SOLVE THAT PUMPING PROBLEM WITH A MOYNO



ONLY ONE MOVING PART

Moynos have no pistons, valves, or high speed impellers—no troublesome end seals—no noisy gears. Only a single-helical rotor turning inside a double-helical stator. This action creates "progressing cavities" that handle the material; forms continuous, *ever-changing* seal lines that prevent concentrated wear. Particles and solids in suspension are swept along without "churning." Rotor and stator are made from materials best suited to the need. No other pump is like the Moyno—*it keeps things moving.*

R & M MOYNO® PROGRESSING-CAVITY PUMP

Time after time, plant engineers have found the answer to their pumping problems in the R & M Moyno "Progressing-Cavity" pump. And no wonder —for here's a unique pumping principle that has no type limitations. Moynos pump virtually *everything* from volatile liquids to non-pourable pastes . . . and *keep on pumping when others fail.*

LONG LASTING—EASY TO MAINTAIN

In hundreds of plants, Moyno "progressing cavities" are regularly handling chemicals, foods, abrasives—many materials that were formerly "un-pumpable." Moynos self-prime, reverse; have low internal turbulence; deliver positive, *non-pulsating* discharge at pressures to 1000 p.s.i. They're *non-contaminating,* with bearings *outside* the pumping compartment. And the entire pump can be torn down, cleaned, and reassembled easily, and with ordinary tools.

Free Book tells how . . .

Available in types and sizes for all needs, Moynos are fully backed by Robbins & Myers' more than fifty years' experience in serving industry. Ask for free Book No. P-22E; it explains "progressing-cavity" pumping, gives capacities, dimensions, uses. Get this guide to better pumping, greater savings—*now.* Write for *your* copy today.

ROBBINS & MYERS · INC. MOYNO PUMP DIVISION
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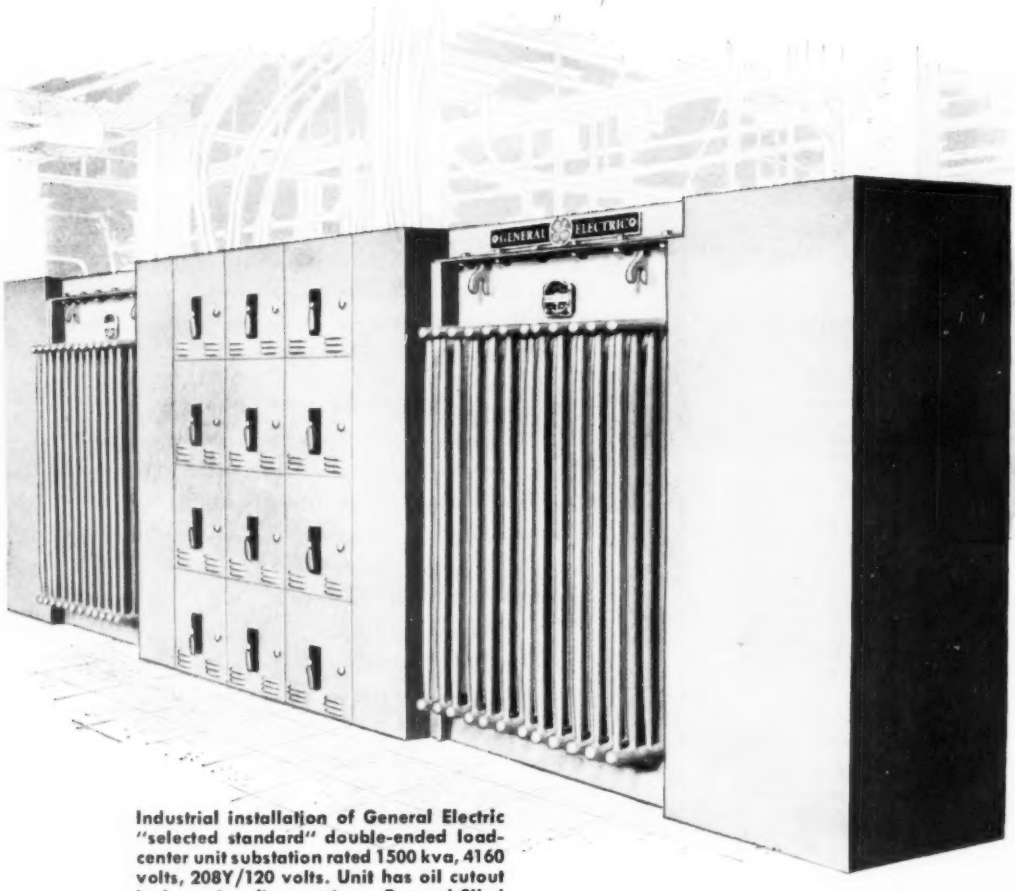
new load center unit



Industrial installation of General Electric "selected standard" double-ended load-center unit substation rated 1500 kva, 4160 volts, 208Y/120 volts. Unit has oil cutout in incoming line sections, Pyranol-filled transformers, and the new AK-1 air circuit breakers.

* *Be sure to see the "More Power to America" full-color sound slidefilm "Modern Industrial Power Distribution." Ask your G-E sales representative to arrange a showing for your organization.*

substations

• improved appearance

Note the smooth, integrated appearance of these new G-E Pyranol® unit substations . . . no more gawky, "old-type" bus-duct connections between transformer and switchgear . . . now you can get the effortless flow of line and power that characterizes quality equipment for locations where appearance is a requisite.

• 'selected standards'

Based on surveyed demands of industry and proposed NEMA specifications, "selected standard" ratings have been inaugurated to bring you these efficient new load centers on shorter shipment. The most popular "selected standard" ratings are:

Low voltage—480△, 208Y/120 volts
High voltage—2.4, 4.16, 4.8, 12, 13.2, 13.8 kv
Kva ratings—300, 500, 750, 1000, 1500, 2000

Certain other "selected standard" load centers are available. Contact your G-E sales representative for further information.

• shorter shipments

By ordering "selected standards," you get really short shipments on Pyranol and dry-type load centers. Deliveries are in line with average plant construction schedules and it is suggested that load centers be ordered when construction begins.

• high impulse levels

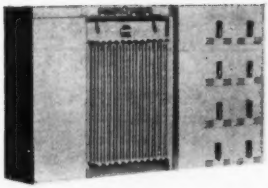
Pyranol unit substations with their inherently high impulse levels are particularly suitable for locations that are subject to switching surges and lightning.

Remember too, that G-E load-center power distribution is the most economical power distribution you can buy . . . no heavy, costly long-run feeders, no "piecemeal" purchases, no divided responsibility.

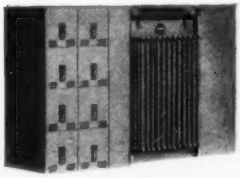
You'll save time too, because G-E "selected standard" load centers eliminate weeks spent over drawing boards detailing individual items; you'll save time because G-E factory-assembled unit substations are quickly and easily installed—in the center of the load area—with lower material and labor costs than required for "piecemeal" assemblies.

Ask your G-E sales representative *today* about how "selected standard" load centers can save time and money in your plant. Also, write for Bulletin GEA-3592.

• *Apparatus Department, General Electric Company, Schenectady 5, New York.*

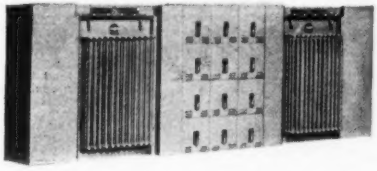


Typical 500 kva G-E "selected standard" load-center unit substation (standard arrangement). Unit consists of primary interrupter switch, liquid-filled transforming section, and low-voltage feeder switching section with the new Type AK-1 drawout breakers.



Same as unit shown above but with reversed arrangement.

Typical 500 kva G-E "selected standard" load-center unit substation with liquid-filled transforming section, metal-clad air power circuit breaker for incoming line-protection, and low-voltage feeder switching section with the new Type AK-1 drawout breakers.



G-E "selected standard" double-ended load-center unit substation rated 1500 kva with primary interrupter switches, liquid-filled transforming sections, and low-voltage feeder switching section with G-E Type AK-1 drawout air circuit breakers arranged for secondary selective service.

GENERAL ELECTRIC

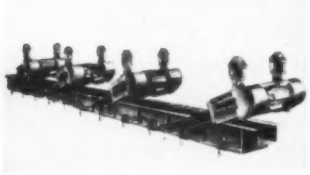
New Products and Methods

WHAT'S NEW? On these pages the Editors summarize the outstanding industrial developments of leading manufacturers who will supply you, free of charge, the bulletins or other information desired. For ease in making requests use the no-obligation, postage-paid card between pages 18-19 or 58-59

1—LONG CONVEYORS

Powered by vibratory motor, for suspension or base mounting

Long vibratory conveyors in various lengths and capacities and powered by one or more vibratory motors mounted either above or below trough, are now available. This conveyor is advantageous in handling extremely hot, abrasive materials—with sealed, tubular troughs to convey dusty, poisonous materials—or in conveying pure foods and pharmaceuticals free from con-



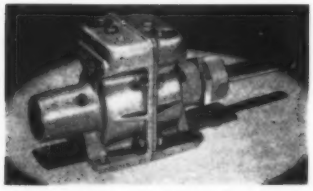
tamination. No belts, idlers or variable speed motors to maintain—movement of the trough is confined entirely to spring system of the vibratory motor—and a dial switch provides variable control of the rate of material flow—both a conveyor and a feeder in one unit.

One unit is a heavy tonnage suspension type with an open flat pan trough, 20 ft long, and is one of four units making up a combined length of 80 ft, for supplying ore to retorts. The trough is equipped with gates located above each retort, for charging as desired. Syntron Co.

2—GEARLESS PUMP

Handles wide range of liquids and viscous fluids

The new Eco Gearless Pump has dual eccentric piston design which gives a strong flow against pressure. Long-wearing body is sturdy naval bronze forgings or stainless steel precision castings. Quiet and smooth running. In four sizes, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$

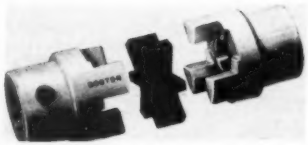


and $\frac{3}{4}$ in., these Eco Gearless Pumps have capacities from 1 to 12 gpm varying with pump speed. Available for use against pressures ranging from zero up to 100 psi. They can be run and will deliver at speeds from 200 to 2400 rpm. Maker says these pumps are built for hard usage. They can be used in various positions and for many operations. Fitted with self-lubricating bearings. Eco Engineering Co.

3—FLEXIBLE COUPLING

Has synthetic rubber insert for quiet operation

A new flexible coupling, for shafts $\frac{3}{8}$ to $1\frac{1}{2}$ in., has simple, accurately machined three-piece construction with standard keyways and set screws. Requires no lubrication and is not harmed by oil, dust or dirt, according to manufacturer. Can be used for a wide range of industrial appli-

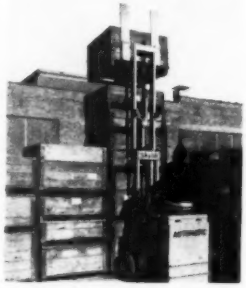


cations requiring flexibility, ruggedness and durability. Designed for quick, simple installation and long, trouble-free service. Boston Gear Works.

4—LIGHT FORK TRUCK

Works in cramped quarters; 1000 and 1500-lb capacities

A featherweight electric fork truck in manufacturer's Skylift series combines lightness, low collapsed height and maneuverability. The 1000-lb model designed for 30-in. load weighs 2360 lb; rated for 48-in. load, 2623 lb. The 1500-lb model weighs 2836 lb. Despite collapsed height of 78 in., both models lift to 134 in., with "free" lift of 68 in. Both are $51\frac{1}{4}$ in. long; 1000-lb unit is $27\frac{3}{4}$ in. wide, 1500-lb is 1 in. broader.



With 30-in. load, truck stacks at right angles in aisle narrower than 8 ft; 48-in. load requires less than 10 ft. The 1000-lb model operates in 48-in. intersecting aisle. This model can have solid or pneumatic tires; with pneumatics safety discs are optional at extra cost. Both models have 2 standard Transporter batteries; automotive type controls; controlled caster-type wheel steer; high-pressure hydraulic lift; manganese alloy steel uprights; dead man control, and simultaneous drive, lift and tilt. Automatic Transportation Co.

5—FLOOR PATCHING

Is lightweight, economical and quickly applied

Patching with Rockflux requires applications only $\frac{1}{2}$ in. thick. This results in less weight on floor understructure, less material required, and quicker application.

A combination of donerite and quartz, fluxed with a cement, its flux is almost zero in calcium and other substances reacting to acids, and is highly acid resistant. Areas paved with Rockflux are ready for traffic the day after application. Surface presented is unaffected by oil and grease and permits free and easy rolling of equipment because of high pressure resistance, said to be three times that of concrete. Flexrock Co.

6—IMPACT BLAST PROCESS

Cleans precision machined parts, delicate instruments

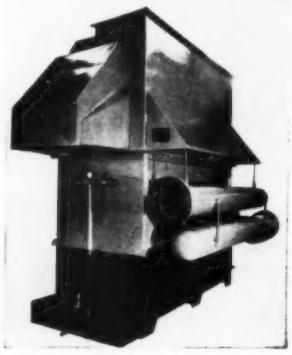
"Hydro-Finish" is a modified form of impact blasting with abrasive suspended in liquid. Extremely fine mesh abrasives can be used, holding within tolerances as close as 0.0001 in. There is said to be no breakdown of sharp edges and corners. The new process is being used in maintenance of

dies and molds, and for final finishing of cutting tools after the finish grind. Hydro-Finish is easily and economically accomplished in a watertight cabinet with hopper tank for mixing, storing and recollecting the suspension. A circulating pump delivers liquid to blasting nozzle and velocity is imparted by an injection of compressed air. Pangborn Corp.

7—AFTER COOLER

Protected against freezing for outdoor installation

The Aero After Cooler dehydrates compressed air or gas by cooling it to temper-

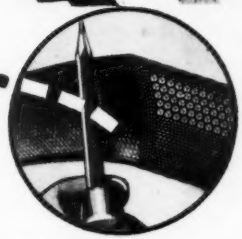


Make this Test with ANY V-Belt

You'll See at Once Why the

CONCAVE SIDE---

(U.S. Patent No. 1813698)



Saves You Money!

Bend any V-Belt and feel the sides change shape. The top of the belt, under tension, *narrows*. The body, under compression, *widens*. The sides of the belt bulge out.

The result, if the belt is built with *straight sides*, is a shape that does not fit the sheave groove—as shown in Figures 1 and 1A, below.

Straight-Sided V-Belt

How Straight-Sided V-Belt Bulges in Sheave-Groove

Clearly, the bulging of the sides will produce excessive wear along the *middle* of the sidewall as indicated by arrows.

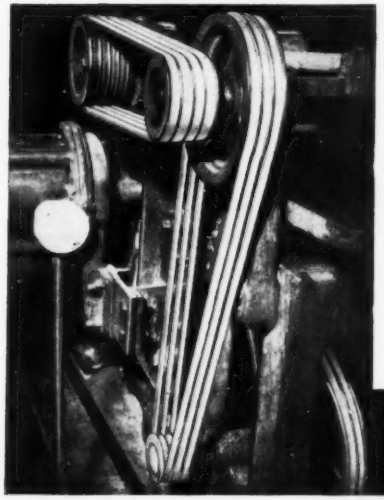
Now, bend a V-belt with the *concave* side—the Gates Vulco Rope.

You get the same shape change but *now* the new shape exactly fits the sheave groove—as shown in Figures 2 and 2A.

Gates Vulco Rope with Concave Side.

No Side Bulge. Precise Fit in Sheave-Groove.

Results? (1) *Uniform* sidewall wear; *longer life!* (2) Full sidewall grip on the pulley. Carries heavier loads and *sudden load increases* without slippage; saves *belts* and also saves *power!*



The Concave Side is *MORE IMPORTANT* NOW Than Ever Before

Because the *sides* of a V-Belt are what actually *drive* the pulley, it is clear that any increased load on the belt means a heavier load that must be transmitted to the pulley *directly* through the belt's sidewalls.

Now that Gates *SPECIALIZED* Research has made available to you SUPER Vulco Ropes—carrying fully 40% higher horsepower ratings—the life-prolonging Concave Side is naturally more important in conserving belt life today than ever before.

THE GATES RUBBER COMPANY
DENVER, U.S.A.
The World's Largest Makers of V-Belts

494

Gates
REG. U.S. PAT. OFF.
The Mark of SPECIALIZED Research

GATES VULCO ROPE DRIVES
Engineering Offices and Jobber Stocks IN ALL INDUSTRIAL CENTERS of the U.S. and 51 Foreign Countries

Save with modern distribution systems using WESTINGHOUSE Dry-Type Transformers

If you are expanding or relighting your plant, you can lower operating costs and gain greater efficiency feeding motors and lights by using a modern distribution system.

In such a system, higher voltages are brought close to the load and are stepped down at the motors and lights they serve with modern, dry-type transformers.

You will:

GET BETTER REGULATION
SAVE COPPER
SAVE INSTALLATION COSTS
REDUCE OPERATING EXPENSES

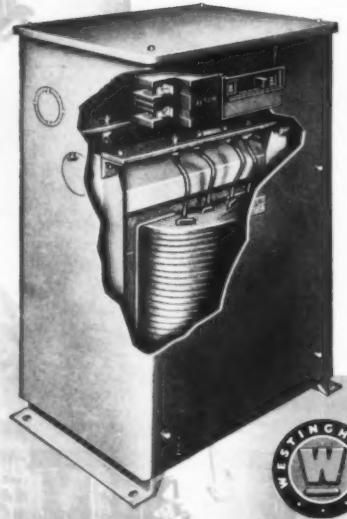
And Westinghouse dry-type transformers will give you additional advantages of **SMALL SIZE AND LIGHT WEIGHT,** important to the men who actually install the transformers.

To get these extra "plus" advantages, Westinghouse leadership in engineering introduced Class B insulation and developed HIPERSIL*, the steel that carries one third more magnetic flux.

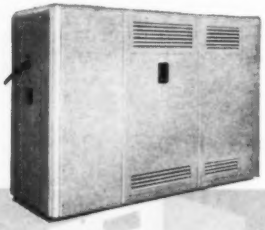
That same engineering is ready to assist you with the proper application of dry-type transformers in the distribution system best suited to your needs. Call or write your near-by Westinghouse office for your copy of Booklet B-4009. Westinghouse Electric Corporation, Transformer Division, Sharon, Pennsylvania. J-70517

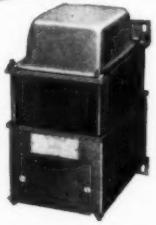
Reg. U. S. Pat. Off.

YOU CAN BE SURE IF IT'S Westinghouse



A NEW FEATURE—Two popular dry types, AJR and AVR, are now offered with or without a built-in circuit breaker. With this new feature, the need for separate protective devices is reduced. AVR-B (with breaker) is shown at left.





ABOVE—Type GP which, with type MT, are small, class A insulation transformers serving loads under 2 kva.

LEFT—Dry-type power center, used indoors as part of modern industrial distribution.

Westinghouse
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

"LEADERSHIP IN TRANSFORMER DEVELOPMENT . . . FOR EVERY POWER DISTRIBUTION JOB"

ature below dry bulb temperature of atmospheric air, thereby removing moisture that condenses at that point and preventing further condensation of water in air or gas lines in use. This is done by evaporating a recirculating water spray on the surface of a coil through which compressed air passes, creating a temperature close to the wet bulb temperature of the surrounding atmosphere and lower than dry bulb temperature and summer surface water temperature.

Protection against freezing is given by "balanced-wet-bulb" control. A thermostat in spray water reservoir is set for a desired low temperature limit at which it operates dampers to recirculate the air steam internally around a division plate in the center of the unit, instead of drawing in freezing air. This permits outdoor installations, to save space and give lowest wet bulb temperature in summer and provide cleaner air for easier maintenance. Said to consume a small amount of cooling water. Prevention of condensation in air lines saves water damage to air tools, paint sprays or materials in process. Niagara Blower Co.

8—MOTOR STARTER

Enclosed, combination type, for use with 2300-4600 v motors

For use in certain hazardous locations this new combination starter (with self-contained disconnect switch) is adaptable for squirrel-cage, synchronous and wound-rotor motors. Known as the Valimitor (volt-ampere-limitor) starter, this unit is claimed to provide unlimited short circuit protection. Regardless of available kilovolt ampere of power system, a fault current in motor circuit is limited to 25,000 kva (steady state current). Its magnetic contactor of 50,000 kva interrupting capacity is more than ample to clear circuit.

An oil disconnect switch isolates starter from power lines. Contactor is mounted in rear oil tank. In front compartment, the overload relay panel gives inverse time element protection for prolonged overloads and trips instantly on short circuits. Nothing to replace after a short circuit; just press button to re-start motor. Built for motors up to 600 hp at 2300 v and 4600 v, 60 cycle service. For 25 cycle power circuits, maximum rating is 300 hp at 2300 v and 250 hp at 4600 v. The Electric Controller & Mfg. Co.

8A—MAGNET TOOL

Works like carpet sweeper to pick up steel scrap

A new design of the Multilift Rotary Magnetool for steel pick-up gives 50 per cent more magnet power and offers improved handling, according to manufacturers. The rotating magnetic tube is propelled manually in carpet sweeper fashion to pick up steel scrap or parts from floors, parking lots, and driveways, for removal of tramp iron from liquids and powders, and for separating steel from other materials. May be attached to trucks. Tools are waterproof and oil-proof and operate without wires or electricity. An acid-proof model for tanks is manufactured.

The magnetic tube rotates with wheels and loads automatically to a thickness of ¾ in. on entire surface. Unloading is done by pushing wiper ring from one end of the tube to the opposite end where nonmagnetic area causes instant release of load. Improved design features include rigidity in frame, and heavier removable handle with rubber grip. Tool won't roll if stood against wall, table or machine. Constant contact with steel will not reduce its magnetic power, it is said. Standard sizes from 9 to 24 in. overall width cost $18.25 to $36.00 fob Detroit. Larger units to order. Multifinish Mfg. Co.

9—NEW BATTERY CHARGER

Combines ease of operation with complete accessibility

"Chargette," a new battery charger for servicing batteries of motorized hand lift trucks, weighs only 115 lb in its smallest rating, and occupies a floor area of just 10⅝ in by 14⅜ in. Easily operated, all truck operator has to do is plug together the charging cable connector and turn the pointer to "normal charge" position. Automatically, the charging current begins at proper value and is controlled throughout the charge at rates prescribed by the manufacturer; charger stops in case of power failure; when power is restored, charging resumes and charger shuts down completely when the battery is fully charged.

Operating instructions are etched on the nameplate; on the inside of the control box cover is glued information on sequence of operation, adjustments and maintenance. Every part of this new charger is readily accessible for inspection and maintenance. Raising the control box lid, hinged at the top, reveals all control equip-

ment. Removing helmet-type motor-generator cover gives ready access to the brushes and generator field rheostat. Made in seven ratings to service lead-acid and Edison batteries. The Electric Products Co.

10—PORTABLE LIGHT

Provides improved illumination for many service jobs

The new 505 light features a concentrating lens which multiplies useful light, and universal mounting which permits aiming light where most needed. Additional wide-area illumination is provided by half-round reflector. Manufacturer says light measurement tests show concentrated light provides 6½ times as many footcandles at 2 ft as plain bulb. This is important for close range work. Universal mounting permits adjustment through full circle horizontally and 270 deg. vertically. Has non-tipping base for stand-up use. Spring steel feet may be removed and the

base fastened to ceiling for overhead light, or the handle and cage may be quickly detached.

All metal parts are zinc-plated steel. Cage has 4 projecting lugs to prevent rolling when the light is laid down, hanging hook, and hard wood handle with fitted socket and Levolier switch. It is equipped with a new vinyl thermoplastic cord which, according to the manufacturer, is unaffected by oils, greases, moisture, common acids or alkalies; wear-resistant and does not become brittle with age. Furnished with 25 ft cord. Special lengths as required. McGill Mfg. Co., Inc.

11—NON SLIP FLOORING

Is easily laid; for stairs, catwalks, ramps, entrances

New Type B "Safety Walk" has a pressure-sensitive adhesive which enables it to be laid "as easily as cellophane tape." It consists of hard mineral grains surface-coated on a toughened fabric, affording non-slip safety underfoot "even when completely covered with water, mud, oil or grease," according to manufacturer. Made in red, green, silver and natural black. "Safety-Walk" is provided in factory-cut stairway strips, brick-size cleats, tile-size cleats, larger all-purpose cleats, and in

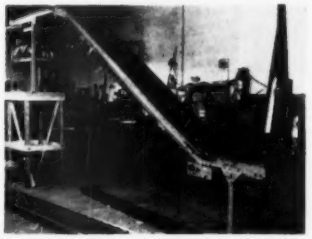
New Products and Methods

roll form. Adhesive coated on underside of material is protected by Holland cloth liner which is pulled off just prior to application. Previous "Safety-Walk" brand non-slip materials, which will continue available, require use of separate adhesive. Minnesota Mining and Manufacturing Co.

12—BELT BOOSTER

For conveyor system; it's built for light-medium duty

This new stationary belt booster is driven by a packaged power unit of ¾, 1 and 1½ hp. Has ball bearing adjustable unit as-

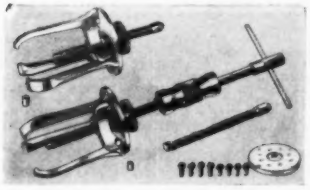


sembly and end rolls. Fully adjustable at all outside points to permit easy belt alignment. Standard angle is 28 deg; special angles made in any degree. Island Equipment Corp.

13—THREE-JAW PULLER

Is easily used to produce safe, uniform power

This puller can be used by any mechanic. Spring tension holds jaws on work, and locking nut makes it possible to lock the puller on the job so it will not come off until released. This allows operator to use both hands for actual pulling operation. This is said to assure slipless, tipless pulling of all jobs within jaw capacity. Jaws are forged and heat treated. Maximum jaw capacity on outside holds is 8½ in., and the jaws are reversible to operate through 2½ in. opening for inside pulls on bearings and sleeves. Yoke is forged with two sets of jaw slots allowing jaws to be



moved closer to the center for better gripping power on small jobs.

Available as either screw type, or combination screw and booster hammer type. As a screw type it can be operated with any ¾ in. wrench and screw automatically centers on all "turned" shafts. For shafts without centering holes a special screw point protector is provided. A circular plate attachment is available to adapt puller for use on water pump and generator pulleys, tapped fiber gears. Unit attaches to gear or pulley close to hub by cap screws, and puller is attached in usual manner. Snap-on Tools Corp.

14—SWING BOOM CRANE

Is gasoline driven, bantam size for use in restricted areas

Model AJ, newest and smallest of the Krane Kars, is a 3000-lb capacity swing boom crane for fast lifting, handling and transporting of materials in narrow aisles, small areas. For indoors or outdoors; users say it saves time and labor in unloading freight cars. Equipped with gasoline driven

New Products and Methods

engine of heavy-duty motor truck and tractor type, 11 gal tank.

Unit is 51 in. wide, 82 in. long, with 11-ft turning radius; weighs 10,500 lb. Has

4 speeds forward, 4 back, up to 20 mph. Standard boom is adjustable from 9 to 14 ft. Three hand levers control operation. Solid rubber or pneumatic tires. Silent Hoist & Crane Co.

15—WICK OILER

Variable feed type, with removable wick retainer

This oiler is recommended for equipment with solid bearings oiled from top, where measured quantity of filtered oil is desirable. Feed of oil is controlled by varying size of wick in tamper-proof base fitting. Greater feed variation can be obtained by using lighter or heavier oil. Will feed oil or liquids as thin as water or as heavy as molasses.

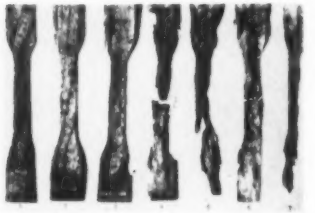
Crystal clear, shatter-proof plastic bottle keeps oil supply visible. All metal parts heavily plated for corrosion resistance, easy cleaning. Large sediment chamber traps dust, dirt, chips and filings—wick completes filtering. Oilers are said to pay for themselves by savings in time, labor and maintenance. One filling of the reservoir lasts a long time. In 4 types—with or without sight-fitting, with or without feed shut-off, and in 1, 2, 4 and 8 oz capacities in each type. Five wicks, of graduated delivery capacity furnished with each oiler. Additional wicks available at low cost. Trisco Fuse Mfg. Co.

16—WOOD PRESERVATIVE

Keeps out moisture and retards rotting and warping

This wood preservative is a new double-action treatment developed to prevent wood from rotting, keep out moisture and reduce possibility of shrinking and warping. Easier painting of surfaces treated with the preservative results, it is said, because it lays the grain of the wood as it is applied.

Important for treating lumber and millwork used in repairs and rebuilding, and



in new construction and manufacture of wood products. Any wood material can be treated, in manufacture or at time of installation. Simple application is made by impregnation, dipping, brushing or painting. When this wood preservative is applied by dipping in tanks or vats, there is no heavy sludge to develop on bottom of the tank, it is claimed.

The photograph was taken after the 7 strips of wood had been buried in soil for an equal period of time. Samples 1 and 2 are treated with Green and Clear Wood Preservative; sample 3 is treated with Clear Wood Preservative, ½ normal strength; samples 4, 5 and 6 are treated with other forms of wood preservatives and show little improvement over control strip, sample 7, not treated.

Because of double strength of its toxic ingredient, Tremco wood preservative could be diluted with good results, but manufacturer recommends it be used without dilution. Furnished in clear, for use where wood will finally receive a clear varnish finish, and green, for use where wood will be painted or left unpainted. The Tremco Mfg. Co.

17—FLOOR RESURFACER

For heavy industrial duty; resists syrups, oils, moisture

Manufacturer describes **Resn-X** flooring as a durable, but resilient heavy-duty resurfacer easily brushed or troweled over any type of floor, concrete, wood, tile, metal or composition, to a thickness of $\frac{1}{16}$ to $\frac{1}{8}$ in. providing a wear-resisting surface that will end chemical and solvent attack. It is said to be non-slip and a top electrical insulator; an ideal safety stair-tread inside or outdoors. Syrups, solvents, chemical corrosives, alcohols, glycols, petroleum solvents, oils, fats, waxes, most acids, alkalis, water, soap solutions, detergents and salt solutions are said to be without effect upon Resn-X. It is recommended for below-grade installations and whenever extreme acid, alkali, fats, oils, moisture, etc., are encountered. It is emphasized that **Resn-X** will not contaminate food.

Comes ready-mixed and can be easily applied. Packaged in 6 gal containers it is available in tile red; utility green and medium gray. Coverage per gallon is approximately 60 sq ft at $\frac{1}{16}$ in. and 30 sq ft at $\frac{1}{8}$ in. thickness. Can be walked on in 6 hours. Dries hard for traffic in 24 hours. Rock-Tred Corp.

18—SOLDERING IRON

Generates own heat; uses no electricity or external heat

A new soldering iron, the Quik-Shot, utilizes chemical cartridge claimed to heat iron to working temperature in 5 sec and maintain it at average soldering temperature at 800 F for 7 min. The cartridge, about the size of a small flashlight battery, is ignited by the impact of a spring rod pulled out and released at back of handle.

Chemical mixture used in the cartridge consists of magnesium-type powders ca-

pable of generating intense heat. This heating action is known as the "thermit" process, whereby heat but no gas is generated. Consequently, cartridge is non-explosive; manufacturers guarantee its safety.

For all kinds of outdoor work, the iron is also handy indoors. Of strong construction, it has no breakable or fragile parts. Heat developed is equivalent to about 250 w peak. Six interchangeable tip sizes are available, from $\frac{1}{8}$ to $1\frac{1}{8}$ in. Retail price, $5.95, includes package of 4 cartridges. Additional packages cost 49 cents and additional tips $1.50. Kemode Mfg. Co., Inc.

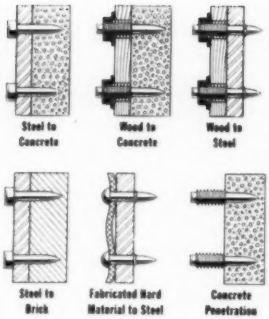
19—FASTENING SYSTEM

Powder actuated; does many construction, maintenance jobs

A new fastening tool line of steel fasteners and powder charges, named "Ramset Fastening System," replaces manufacturers' former Tempotool fastener. The new tool is actuated by a powdered charge of several different strengths, which upon being exploded within the tool force the steel studs or pins into steel, concrete, masonry and other hard materials without drilling or plugging.

Tool is said to operate instantly, only 30 sec. being required to prepare the tool and set fastener into place. In two sizes: the smaller one weighing less than 5 lb, costs about $70 and the larger one, about 10 lb, about $140.

Both are said to include improvements over manufacturer's previous models, espe-



cially in safety devices and control of fastener penetration. Applicable for installation of electric equipment, conduit, automatic sprinklers, lighting, piping, heating, air conditioning, plastering, flooring, siding and roofing. Stemco Corp.

20—DIRECT-FIRED HEATER

Is small-sized packaged unit for use in limited areas

The new Thermobloc Model 300, direct-fired unit heater has same characteristics as manufacturer's larger model now on market, except for size and output. This new unit is 7 ft high and 30 in. diameter with an output of 300,000 Btu. It is completely packaged with only the fuel, elec-

trical and flue connections necessary to place it in operation. Heated air is delivered directly to the working area without excessive velocity. Waste is said to be minimized. Completely automatic features of Thermobloc permit its independent operation and accurate adjustment to heating needs. Described as ideal as dryer, or for circulating cool air from the floor level to the working level, and as perfect portable heating unit for construction jobs. Thermobloc Div., Prat-Daniel Corp.

21—ELEVATOR BUCKET

High speed type, it handles free-flowing materials

The design of this bucket is said to combine high capacity, durability, low operating cost and exceptional strength with light weight. Recommended for handling grain, soft feeds and other fluffy, granular or powdered free-flowing materials which are not excessively abrasive. These buckets may be mounted on belt at intervals or continuously, depending on capacities required. Have spot welded construction, tapered ends for maximum pickup and for nesting in storage and shipping, smooth interiors, uniform strength throughout. Can be installed to replace old buckets on existing elevators. Link Belt Co.

22—SMALL FLOOR CRANE

Hydraulic, half-ton capacity, it works in close quarters

This little crane turns completely around in its 5 ft 3 in. length and can work in a 3-ft aisle. Solves load handling problems where floor area doesn't permit use of larger cranes and is convenient extra equipment in large plants. It is 2 ft $7\frac{1}{2}$ in. wide; 4 ft $7\frac{1}{2}$ in. high; weighs 235 lb. Boom extends from 46 to 58 in. Has strong

IS YOUR SLIPPAGE SHOWING?

..Important question for users of reciprocating pumps and air or hydraulic cylinder mechanisms

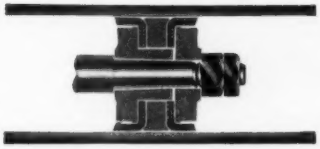
ILLUSTRATIONS at right show how Darcova Pumcups, in contrast to ordinary piston packing, virtually eliminate fluid slippage for the entire life of the packing. And, Pumcup life is many times that of ordinary packing.

By holding slippage to an absolute minimum, Pumcups permit reduced operating speeds, maintain high volumetric efficiency, prolong equipment life, save power, prevent wire-draw and uneven cylinder wear, and eliminate the need for frequent replacement shutdowns.

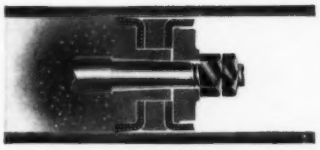
So if slippage is showing up in your operating and maintenance records . . . if replacement of packing is a too-frequent chore, that's your cue to switch to Darcova Pumcups.

For a free bulletin containing complete information, write, or use the coupon below.

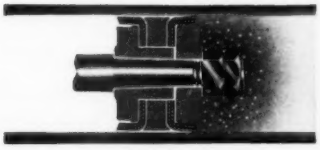
DIAGRAM OF PUMCUP ACTION GREATLY EXAGGERATED



NORMAL: BOTH PUMCUPS RELAXED



UNDER PRESSURE: PUMCUPS SEAL AGAINST CYLINDER DESPITE WEAR, MINIMIZING SLIPPAGE



Darcova Pumcups replace ordinary packing in reciprocating pumps and also in air or hydraulic control mechanisms. They are precision built of an exclusive, exceptionally durable composition material available in many textures for use with almost any fluid under a wide range of pressures and temperatures. Standard sizes range from ½ to 42 inches in diameter.

DARLING VALVE & Manufacturing Co.
WILLIAMSPORT, PA.

Darling Valve & Mfg. Co., Williamsport 14, Pa.
Please send me the free bulletin checked below:
☐ No. 4401... Darcova Pumcups for reciprocating pumps.
☐ No. 4502... Darcova Pumcups for air or hydraulic mechanisms.

NAME _____
COMPANY _____
ADDRESS _____
CITY _____ STATE _____

New Products and Methods

steel hook. Double-acting pump works on both forward and backward strokes. Steel load-carrying and caster wheels are regular equipment, but hard rubber wheels are optional at no extra cost. Ruger Equipment Co., Inc.

23—BOX TYPE HAND TRUCK

Of steel construction; for handling light parts

This truck has four pneumatic tires; the two larger are stationary. Maneuverability and operating convenience are added by two pivot wheels at the pushing end. Two

hand levers at the pushing end permit the operator to unlock the box at front bottom for easy disposal of parts. Boxes are manufactured to customers' specifications. Palmer-Shile Co.

24—TRANSFORMERS

Three-phase distribution type for small loads

Incorporating all protective features of manufacturer's CSP (completely self-protected) single-phase distribution transformers, these new units have built-in De-ion lighting arresters, 3 mechically interlocked, heavy-duty circuit breakers on the secondary side as safeguards against overloads and short circuits, and primary protective links for system protection. These transformers are made possible by a secondary breaker capable of successfully interrupting 10,000 amp by the usual secondary voltages. They come in sizes of 9, 15, 30, 45 and 75 kva for primary voltages of 2400 to 14,400 inclusive and with secondary voltages of 208Y/120, 240 delta, 240 by 480 delta for primary classification in accordance with present standards. Designed to incorporate electrical and mechanical features suggested by EEI-NEMA fourth report on Standardization of Distribution Transformers. Equipped for mounting on poles, platforms or mats as required. Westinghouse Electric Corp.

25—SOCKET PROTECTOR

For use with most medium base brass shell sockets

Ajusco-Loc socket protector is designed to provide maximum protection against breakage of lighting sockets. Assembly consists of a solid die-cast socket cap with a minimum wall thickness of $\frac{1}{16}$ in., a 16 gage steel ring, and three brass screws. Easily and quickly attached to socket by placing socket body in cap, sliding steel ring over socket body until it rests on socket shoulder, and slipping the screws thru the holes in the ring and screwing into cap. Die-cast lug inside cap fits into switch-button slot in socket shell to prevent twisting. When so installed and with normal use, the Ajusco-Loc is guaranteed against kinking or breaking of cap, body and cap breaking apart and body cap twisting in relation to each other. Designed to cut replacement costs of sockets and wiring, reduce danger of blown fuses, electrical shock, and fire and will reduce work losses during shutdowns for repairs. Of durable construction, the Ajusco-Loc is moderately priced, and available in $\frac{1}{8}$ or $\frac{3}{8}$ IP thread as separate assembly or complete with pull chain, key, or push-thru socket. Adjustable Fixture Co.

26—EXPANSION JOINTS

For handling fluids or gases and absorbing vibration

These expansion joints are used under conditions of vacuum, pressure and temperatures up to 250 F. Manufacturer says their strength, durability and safety are achieved through a special built up construction employing rubber, duck and metal. All movement occurs in the center corrugation, which offers plain, but efficient operation. Width of the corrugation is determined by extent of movement required. Patented Flang-Lok flanges included with each joint, in cast iron or cast steel, are easily installed. Only flange needs to be turned (not joint or pipe) to align bolt holes with connecting flange. As bolts are tightened, rubber end of joint is compressed over a broad area against connecting pipe, forming a leakproof, rubber-cushioned seal. Magnitude of forces forming seal is in direct proportion to stress applied to bolts. Goodall Rubber Co.

27—FIRE RETARDANT PAINT

Is also non-toxic; for use on all interior raw wood surfaces

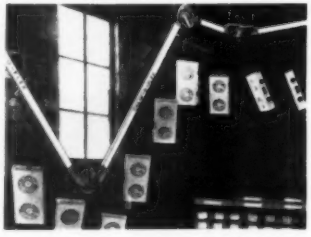
Called Flame-Seal, this new paint is easy to handle, ready to use, requires no special ingredients, and can be applied directly from original container by brush or spray-gun. Manufacturer reports that tests show Flame-Seal generates no smoke or toxic gases when attacked by fire and gives off no toxic fumes while being applied. It is claimed that unpainted lumber protected with a coating of Flame-Seal, can withstand a 2000 F blow-torch for 30 min. without any flame spread.

Flame-Seal has been tested on fast-burning woods and is described as ideal protective coating for use on wood walls, ceilings, basements, attics and stairwells. When fire attacks wood coated with Flame-Seal, says manufacturer, the paint forms a "magic" white crust which creates a hard protective wall at least 8 times thickness of original coating. The new fire-retardant paint is also said to be moisture-proof and termite proof, and will not craze, chip, peel or crack. Can be washed with any standard soap or washing powder. Available in an oyster-white flat finish in single quarts, 2 and 5 gal. cans and 55 gal. drums. Stallton Chemical Corp.

28—OVERHEAD CONVEYOR

Flexible chain "packaged" system for quick assembly

Chain-O-Flex is adaptable for use where constant flow of material or assembled products is needed. Permits quick assembly of any practical conveyor system pattern. All parts are bolted together like an erector set. All corners are flexible and adjust-



able to any desired degree. Chain-O-Flex increases its efficiency when the number of corners is increased. Variable speeds are obtained by adjusting band wheel on drive unit which will provide a 3:1 speed ratio. Multiple drive units may be used on extremely long systems. Enclosed design throughout. Chain-O-Flex Corp., distributed by Industrial Equipment Co.

29—BAND SAW

Makes intricate cuts in steel, plastic, foam rubber

The Tyler band saw will cut any line that can be drawn, according to its inventor. Its performance is made possible by its spiral blade which presents a 360° cutting edge that cuts smoothly in any direction, and planetary transmission which provides a saw speed range of from 70 fpm (for tough metals) to 5,000 fpm (for light materials). Special tough rubber-tired guide rollers hold blade to necessary rigid cutting line.

It is said that operator can cut any pattern without turning work; can saw to center of any material 24 in. wide and any length, and work from either right or left side of band saw. The Tyler spiral blade has no saw tooth edge. The operator can accidentally touch the moving blade with his hand or fingers without injury, it is claimed. The Tyler Mfg. Co.

Do you want more information on this equipment and its application? Use the no obligation, no postage card between 18-19 and 58-59

30—TOOL CHEST

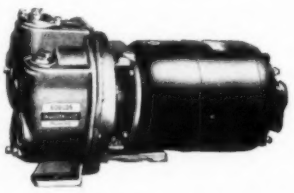
Contains 146 pieces; is built to last, smartly designed

The new Superchest No. 2001 contains sockets and attachments in $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$ and $\frac{3}{4}$ in. drives; wrenches, pliers, chisels and screwdrivers, 146 pieces in all. Tools cover wide range of work from industrial applications to ignition and electronics. The chest is constructed of heavy gage steel heavily reinforced and welded. Has drawers with handy compartments, removable tote tray with convenient compartments which keep sockets at proper height within easy finger-tip reach, and cylinder lock. J. H. Williams & Co.

31—COMBINATION PUMP

Is designed for smaller capacities against high pressure

The "Industri-Jet" pump is a combination of the centrifugal pump with the jet or ejector in one compact unit. Built in sizes $\frac{1}{2}$ to 5 hp for capacities up to 35 gpm and pressures up to 190 lb depending on capacity. Suitable for handling hot or cold water, kerosene, gasoline, alcohol,



carbon tetrachloride. Adaptable for general water supply, water circulating service, condensate return, boiler feeding, filter press service, air conditioning and refrigeration, spraying and booster service. Advantages stressed by manufacturer include no close clearances, no air or binding vapor, high suction lifts and automatic recovery of lost prime. Goulds Pumps, Inc.

32—AIR INTAKE SNUBBERS

For 2- and 4-stroke Diesel, gas or dual-fuel engines

These snubbers are also adaptable for intake of all centrifugal and positive displacement compressors and blowers. Designated as manufacturer's series SDA, these units come in pipe sizes from 1 to 30 in. Incoming pulses of air are snubbed so oscillating flow of air, which causes "pumping" noise, is smoothed to a unidirectional flow. There is said to be no appreciable restriction of intake pipe, and vibration and chugging are eliminated. No tuning of air intake system is necessary. Air intake snubbers are commonly used in series with removable filter element to insure clean intake air, according to manufacturer. Burgess-Manning Co.

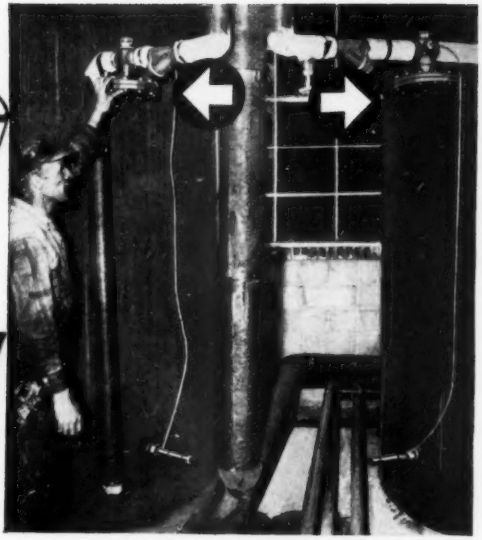
33—FLUORESCENT LIGHT

Gives fine performance; looks good, too

When illuminated, side and spill lighting give the Guthlite, Jr., a beautiful radiant glow. Luminous effect is accomplished without glass or plastic panels, so there's no breakage or warpage. Diffuse aluminum louvres provide comfortable shielding and

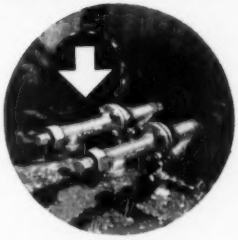
OIL WAX and MOLASSES

on the Run with SARCO



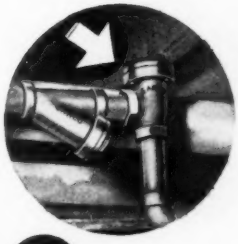
Sarco 2430 Control on wax storage tanks

Why set up an expensive plant and allow slow-downs because the liquid materials won't run fast enough? From initial storage of raw materials to final processing and packaging, there is a Sarco Hook-Up for steam traps and temperature controls that will make everything run smoothly with minimum fuel and pumping costs.



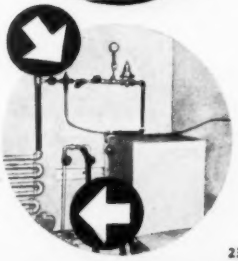
Sarco Thermoton Trap-Control on bulk oil storage tanks

Out-door tanks are trapped and controlled by the inexpensive Sarco 87-C Thermoton which cannot freeze. For close control and indoor tanks, several types of Sarco Traps and Controls are available. Removal of air from lines can be accomplished in many ways.



Sarco No. 9 on creosoting retorts

It's a case where all Sarco products work together as a team to make your plant automatic, and use less fuel. The Sarco Representative near you can show how it is being done in plants similar to yours.



Sarco KR-14 controls temperatures of molasses in receiving room

237

SARCO
SAVES STEAM

SARCO COMPANY, INC.
Represented in Principal Cities
Empire State Building, New York 1, N. Y.
SARCO CANADA, LTD., TORONTO 5, ONTARIO

New Products and Methods

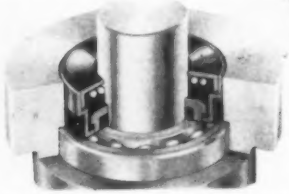
a pleasing brightness at normal angle of view.

Features an easy-to-open hinge so louvres may be hinged to either side, or completely removed for easy lamp and starter changes. The Edwin F. Guth Co.

34—PACKAGED SEAL UNIT

For horizontal and vertical rotating shafts

With both rotating and stationary surfaces built inside a metal cartridge, this seal permits low-cost, fool-proof installation, according to manufacturer. Called the Unit Seal, it uses a radial seal joint which does not wear on the shaft, bearing race or any other parts in the machine pump. Seal is factory assembled, and flat seal surfaces are placed in position to remain in perfect contact without warping.

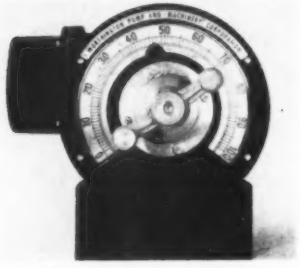


Stationary seal nose is permanently fastened to inner edge of synthetic rubber diaphragm, with outer edge permanently fastened to outer seal case to achieve a positive leakproof flexible connection between seal case and seal nose. Easy flexing diaphragm eliminates no need for heavy spring pressures. The spring is required only to keep rotating and stationary seal surfaces in leakproof contact. Gits Bros. Mfg. Co.

35—DECANTING GEAR

For use with water softeners of the precipitating type

This new decanting gear automatically lowers swing-pipe decanting tube in chemical softening tank to the softener in proportion to raw water flow. Its operation is paced by the raw water meter. Dial in-



dicates amount of chemical liquid in tank. Connections are provided for attachment of an electric low-level alarm. Tube is positioned by flexible cable attached to shaped and grooved drum. Rotation of drum pays off cable and lowers decanting tube. Water Softener Section, Worthington Pump and Machinery Corp.

36—BLAST GUN

Air operated for sand-blasting or spraying solvents

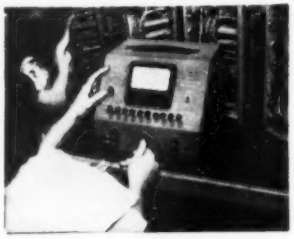
The Enpro combination blast gun improves and simplifies surfacing, cleaning and finishing. Air operated, portable and efficient; it is claimed to leave no buffing marks, grooves or ridges, or scuffed, gouged or uneven surfaces. Has no shafts, wheels or motors. It's particularly useful in reaching inaccessible places.

The gun can be connected to any air line and is equipped for sand blast operations or spraying solvents and liquids. The nozzle is easily changed. Two attachments are supplied; an "abrading" case-hardened nozzle for use in "blast" operations, and a "solvent" nozzle for use with oils or chemicals. Abrading nozzle has a tip that shows wear when barrel needs replacement. Engineered Products, Inc.

37—VOLTMETER

Vacuum tube type, for measuring low circuits

The Type AA-1 vacuum-tube voltmeter measures voltage in electronic and other low-energy circuits where minimum current drain is desirable. This highly sensitive new instrument has a calibrated range of 0.001 v to 300 v at all frequencies from 10 cycles to 1.5 megacycles, and is graduated in decibels, covering a range of -52



to plus 52 from reference level of 1 milliwatt at 600 ohms. Ten-position push-button switch permits any working range to be selected instantly without passing through intermediate ranges. For portable or bench use, voltmeter is housed in aluminum case with sloping front panel which supports indicating instrument at convenient reading angle. Terminals for wires or standard banana jacks are provided for connection to measured circuit; another set of standard banana jacks is furnished for taking off amplifier output. A 6 ft., two-wire rubber insulated cord, with molded rubber plugs, connects 115-v supply circuit to protected receptacle at the rear of instrument chassis. Meter and Instrument Div., General Electric Co.

38—FIRE EXTINGUISHER

Dry chemical type; for electrical, flammable liquid fires

A new dry chemical type fire extinguisher, according to manufacturer, has longer range, longer duration of discharge, more complete discharge of the dry chemical contents, gas-tight, all-internal expelling gas connections, built-in safety disc, and is lighter in weight.

The dry chemical is nontoxic, non-corrosive, nonconductor of electricity, and will not freeze. The new unit has the Underwriters' Laboratories label and is rated B-1 and C-1. It is a hand portable unit identified as No. 30 Aifco Dry Chemical. American-LaFrance-Foamite Corp.

39—WET MOP

Extra durable and long wearing for industrial use

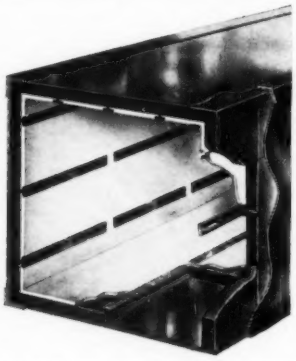
The 16-ply "Victory" mop is available in weights for use with any mop holder. It is claimed to reduce wet mop bills through longer life. Works equally well on rough floors, smooth floors, concrete, tile, wood or terrazzo; absorbs freely, and does not leave strings or chunks of cotton behind its trail. Its makers say that because Victory wet mops are made of tough, long-fibre cotton and uniformly spun, unwinding is slowed to a minimum, hence they last longer. American Standard Manufacturing Co.

40—DUCT LINER

Provides means of securing insulation to steel shell

In announcing a new product called Insuliner, manufacturer says this construction can be applied in the plant without outside engineering assistance. It is said to provide a definite means of securing insulation to the steel shell, to protect surface of the insulation, and make maintenance unnecessary because it is properly supported. This construction is described as block insulation supported by system of bars held in position by bolts welded to

Do you want more information on this equipment and its application? Use the no obligation, no postage card between 18-19 and 58-59



steel shell. The insulation is then covered with an Insuliner cement to protect it and resist a reasonable amount of abrasion. M. H. Detrick Co.

41—SMALL STEAM TRAP

For small drainage and light condensate load jobs

Steam trap No. 118 was developed to provide a smaller trap at lower first cost, suitable for unit heaters, pipe coils, sterilizers, and laundry equipment. May be installed either as an elbow or straight-in-line without extra fittings as only one pipe nipple is required. A blow-down plug and test plug permits easy cleaning and testing. For pressures up to 150 lb has a capacity rating of 700 lb per hour (continuous flow) at 20 lb pressure. In ½ in. pipe connection size.

No. 118 has standard construction for manufacturers' line of steam traps. An inverted bucket type, it has castings of nickel semisteel, bucket and guide tube of copper and bronze, and all working parts of heat-treated stainless steel. The simplified design reduces both installation time and number of fittings. Trap may be inspected without removal, and any or all parts renewed in 3 min., it is claimed. Equipped with thermal air eliminators at slight extra cost. The V. D. Anderson Co.

42—SIGNAL SYSTEMS

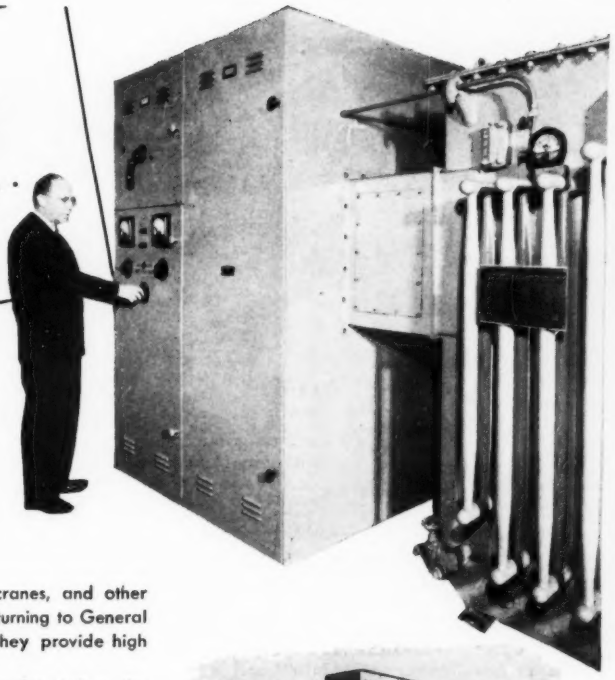
Multiple Signal and Alarm Systems for Industry

Panalarms, a new conception in industrial signal systems, are multiple signal and alarm systems designed for a broad range of use in process work, power plants and all applications where sound and visual alarms are required to indicate failure or changes from normal. They are designed to make possible safety shut-downs, sequencing or inter-locking of plant operations. They may be actuated by any remote switch, thermostat, float-switch, or from changes in any type of equipment that can be reflected by an electric impulse to open or close a small relay.

To insure safety and reliability, the lamps glow dimly during normal opera-

(Continued on page 54)

POWER COSTS . . .
down 33%
YEARLY REPAIR COSTS . . .
$2500 less



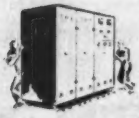
Universal Battery Co. uses General Electric rectifiers to get LOW-COST D-C POWER

To get low-cost d-c power for machine tools, cranes, and other equipment, more and more industrial plants are turning to General Electric mercury-arc rectifiers. Easy to install, they provide high over-all efficiency at full or partial load.

This 150-kw G-E ignitron rectifier, one of two located at the Universal Battery Co., Chicago, converts 220 volts a-c to 250 volts d-c for charging 2600 batteries daily. Mr. Emil Arnst, chief engineer, says that the rectifiers save more than $2500 yearly in repair costs, and cut power bills by one-third. In his opinion:

"If we had to replace the rectifiers at three times their cost, they would still more than pay for themselves."

Find out how you can put d-c power into your plant at a saving. Call or write your nearest G-E sales office for information on a size to fit your needs. *Apparatus Dept., General Electric Company, Schenectady, New York.*



Low Cost Installation . . . because G-E Mercury-arc Rectifiers have no major rotating parts, they can be installed quickly and easily any place that is reasonably level and capable of supporting their weight.

Low Cost Operation . . . because G-E Mercury-arc Rectifiers give you high efficiency over a wide load range, with low no-load losses, and at low cost maintenance, their operating costs are naturally low.

Low Cost Maintenance . . . because G-E Mercury-arc Rectifiers only require periodic inspection of the equipment, and because they can handle momentary overloads without increasing maintenance, the cost of upkeep is kept at a bare minimum.

G-E MERCURY-ARC RECTIFIERS MEAN LOW-COST D-C POWER

GENERAL ELECTRIC

SMALL TRAP

BIG *Performance*

Little? Sure. But what a giant's job they do!

That's how men judge Yarway Impulse Steam Traps.

Yarways are well suited for trap service throughout industry. The small size itself is an important feature. They are easy to install, fit in anywhere, require no special supports.

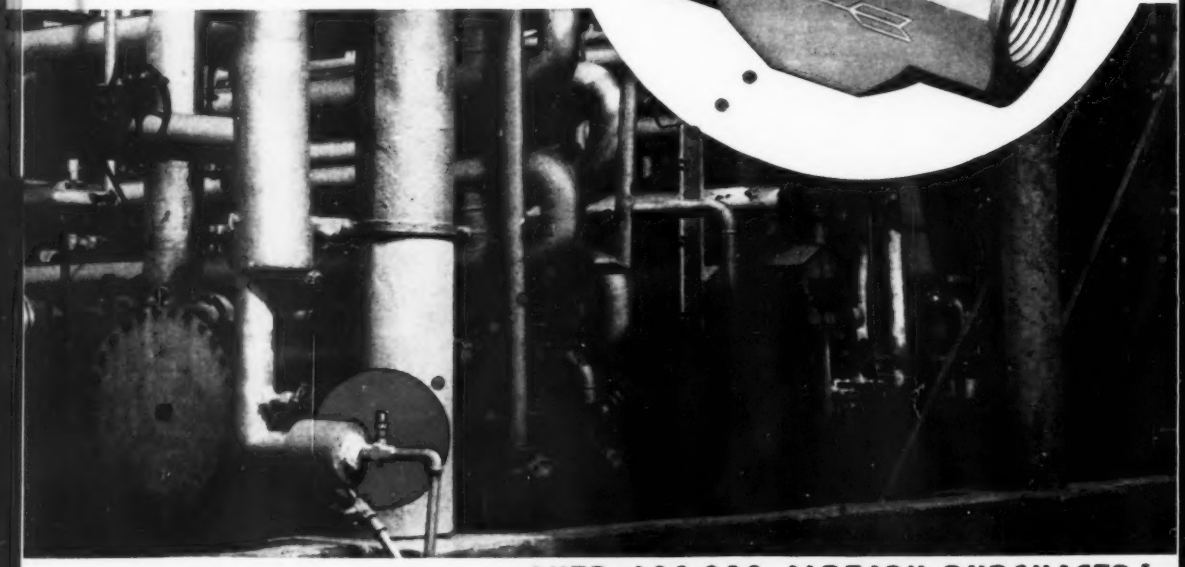
In service they *drink* condensate, discharging *continuously* on heavy loads, at short *intervals* on light loads—providing maximum heat in the shortest time, and keeping equipment at top efficiency.

Yarways are suitable for all pressures without change of valve or seat. Simplicity of construction (only one moving part) minimizes maintenance. Also, initial cost is low.

Try some Yarways today—standardize on them tomorrow. See your nearest Supply House or write for Yarway Bulletin T-1739.

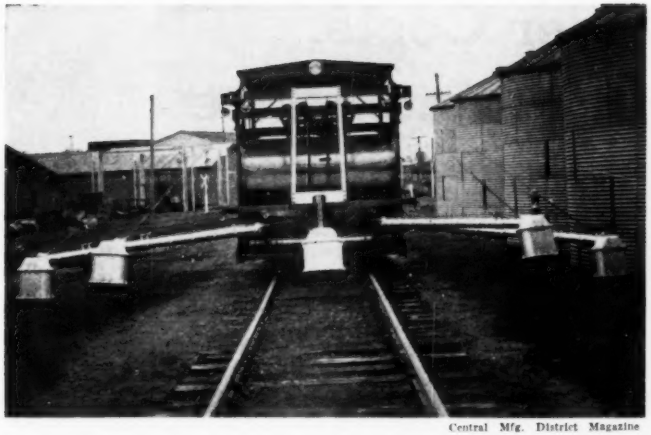
YARNALL-WARING COMPANY

145 Mermaid Avenue, Philadelphia 18, Pa.



OVER 600,000 ALREADY PURCHASED!

YARWAY IMPULSE STEAM TRAP



Central Mfg. District Magazine

● **Flame Thrower**—There are more ways than one to keep your plant yard clean. The odd appearing machine in this photograph is a snow melter and weed burner devised recently by Chicago Junction Railway Co. Burning speeds vary from 4 to 10 mph depending on material to be destroyed

Plangineering

Planning, ingenuity and engineering are responsible for the successful completion of many projects. If you have done a job you're proud of send us a photograph and brief description. Every one accepted from a reader will be paid for. Photographs also are accepted from manufacturing concerns.

Nelson Stud Welding Div.

● **Stud Service**—A typical bathroom anchor plate is shown here secured to wall studs with U-bolts. Stud technique eliminates business of running nuts on through-bolts which sometimes fall out and cause trouble

Stanley G. Flagg Co., Inc.

● **Silver Thread-less**—Refrigeration system piping in Madison Square Garden is composed of new type black malleable threadless fittings. Silver alloy was used for brazing the 3000 fittings installed on job. Pressure testing revealed very few leakers in the 6000 joints installed on the job

● **Like a Leech**—Below: Brick anchors, made of Monel, are now used for securing masonry to building framework. The "keystone" shaped end of the anchor is fitted into the Monel channel which is installed in framework column. Design prevents vibration, dried-out motar, stresses, increases safety

International Nickel Co.

Heat Exchanger Costs, Selection and Maintenance

Small and large plant viewpoint on standardization . . . Costs on a square foot and installed basis . . . Effect of tube size and length, operating pressures, and materials on first cost . . . Installation and maintenance . . . Cost and time for retubing . . . General rules for application . . . Details of common designs . . . Advantages, disadvantages and limitations of various types

By A. LEVINE, Asst. Chief Engineer Condenser Service & Engineering Co., Inc.

PRACTICALLY every plant has one or several types of heat exchangers installed as part of power production, air conditioning, refrigeration, heat reclamation or process work. With the continuing increase in labor and material costs it has become extremely important to choose the least costly type of construction consistent with the thermodynamic and physical conditions involved.

Depending on the industry, the heat exchanger installation may be a large or small part of the capital investment and maintenance cost. In large installations, such as refineries, it is often less costly on an overall basis, to standardize on one tube size and length as well as on one type of construction for all exchangers, even though in a particular case the standardized design may be the most costly. In standardized plants, a relatively small inventory of a few spare parts and tools can service all the exchangers in the installation.

Costs

Smaller plants are able to exercise more freedom in specifying heat exchanger equipment and achieve a combination of minimum capital investment and maintenance costs through the judicious choice of heat exchanger equipment. Where only a few exchangers are involved, it frequently pays to have outside organizations do major maintenance work leaving the plant personnel free of all but periodic cleanings.

A discussion of heat exchangers would be incomplete without reference to costs. There have been several price basing techniques developed the most widely used being that represented by Fig. 2. giving the cost in dollars per square foot as a function of total surface. Since, for an exchanger of fixed surface, the cost varies with tube size, tube length, working pressure, type of construction and materials of construction a curve should be presented for each possible combination.

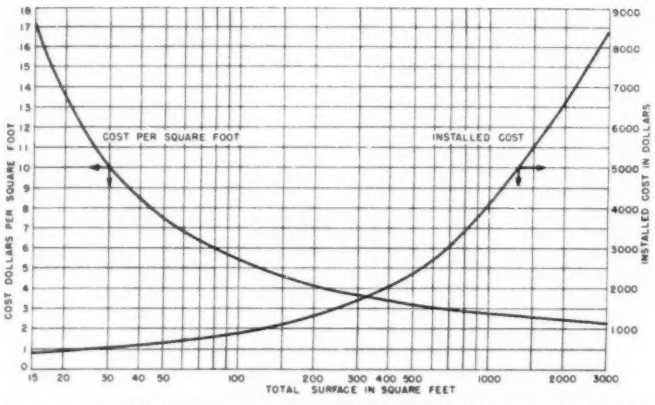

COST PER SQUARE FOOT
INSTALLED COST
COST DOLLARS PER SQUARE FOOT
INSTALLED COST IN DOLLARS
TOTAL SURFACE IN SQUARE FEET

Fig. 2. Cost approximation curves for a packed head (Fig. 5) heat exchanger for 150 psi with: Muntz metal tube sheets; cast iron heads; steel shell; and, No. 18 BWG Admiralty metal tubes, 5/8 in. O.D. and 12 ft. long. Cost factors for other service conditions and design conditions are given in Fig. 1 and in the text

It is obvious that a very large number of curves would be involved which, with the rapidly changing wage and price structure, would at best give only approximate values. A much shorter cost approximation technique has been developed and is presented below. Accurate costs can only be obtained by submitting specifications to manufacturers for quotations.

The dollars per square foot curve of Fig. 2 covers exchangers of the packed head type (Fig. 5) for 150 psi design pressure with 5/8 in. OD, No. 18 BWG Admiralty tubes 12 ft long; cast iron heads; Muntz tube sheets; and, a steel shell. Figure 1 gives relative cost factors for design pressure, tube size and tube length using 150 psi pressure, 5/8 in. OD tubes and 12 ft tube length as unity.

Factors for change in construction materials from the standard of Fig. 2 can be approximated from the following figures. For change in tube side (tubes, tube sheets and heads) material: to steel, 0.85; to

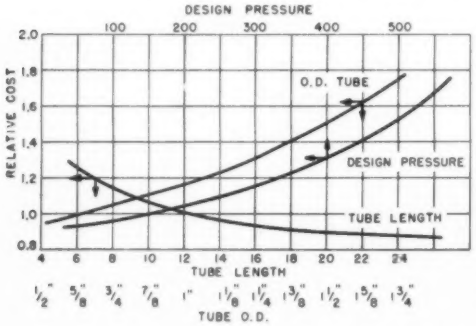


Fig. 1. Cost as influenced by operating pressure, tube length and tube diameter. The index of 1.0 refers to design conditions applicable to the square foot cost curve of Fig. 2

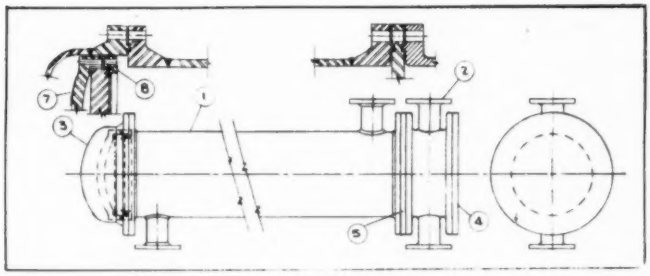


Fig. 3. Full floating head exchanger common in refinery and process work. They can be designed for any pressure and can be used over wide temperature ranges for liquid-to-liquid heat exchange. Cost factor, 1.25. Legend for symbols in all drawings are shown by Table I

Table I. Legend applicable to symbols used in Figs. 3 to 12 inclusive

1. Shell	7. Return cover
2. Channel	8. Split ring
3. Shell cover	9. Packing ring
4. Channel cover	10. Metallic packing
5. Inlet tube sheet	11. Fibre packing
6. Return tube sheet	12. Packing
	13. Expansion jt.

bronze, 1.1; to cupro nickel, 1.5; to stainless steel (type 304), 1.7; to Monel metal, 1.8. For change in shell side material (shell, tied rods, spacers, baffles) from steel: to copper, 7.5; to stainless steel (304), 12.5. Factors for other combinations may be estimated from the foregoing figures.

Approximate factors for construction types can be given, but the reader should not construe the presentation of this data to mean that the various types of units are interchangeable for any service. The factors only indicate the relative costs of construction compared to the packed head type.

Assuming the cost of the packed head type to be unity, the cost of alternate constructions, for the same surface, tube size and tube length are: U-bend (Fig. 7), 0.8; fixed welded tube sheet (Fig. 8), 0.9; fixed bolted tube sheet (Fig. 11), 0.95; full floating head (Fig. 3), 1.25; external packed head (Fig. 6), 1.30; internal floating head (Fig. 4), 1.4.

Figure 2 also shows the installed cost of standard packed head (Fig. 5) heat exchangers as a function of total surface. To determine the installed cost of exchangers, which vary in any respect from the standards of the dollars per square foot curve of Fig. 2, the installation cost of a packed head unit of the same surface should be determined. This amount should then be added to the cost of the particular exchanger under consideration.

Working conditions in the plant, as well as the position of the heat exchanger with respect to the grade, affect installation costs. For a fixed surface, any of the design variables already mentioned affect not only the cost of the exchanger but also the cost of foundations, staging, rigging and other sundry expenses. Therefore, values shown indicate cost magnitude only and should not be used for close estimating.

In general, Figs. 1 and 2 indicate the least costly exchanger for a given surface to be the one with the longest tube length and smallest tube. While this is true for the exchanger itself consideration must be given to operating and maintenance costs. These costs increase with increasing tube length and decreasing tube size because of higher pressure drops and the difficulty of cleaning and replacing long, small diameter tubes. In addition, space costs increase because of the larger clear area required for setting and retubing.

As regards installation costs, long exchangers require more expensive foundations and, if the unit is to be hung from the roof trusses, extensive staging is required for retubing. Long units should be set as close to the grade as practicable. This is extremely important in the chemical industry where rapidly fouling liquids are processed and frequent cleaning is necessary.

Retubing

Some remarks concerning retubing would be of value but conditions vary so greatly from plant to plant that it is almost impossible to give even an approximate cost picture. It is obvious from what has already been stated that the design variables, as well as working conditions and unit preparation for retubing, affect the retubing cost. More often than not, outage time is more important than retubing costs. This is particularly true in continuous flow processes such as power plants and refineries.

Skilled crews with specialized tools can cut outage time to a minimum and effect retubing at a cost of $1 to $3 a tube (exclusive of material costs) depending on conditions. For example, the author has seen such crews retube T-2 tanker main condensers containing 3600 tubes in 72 hr; refinery exchangers up to 1000 tubes in 48 hr; and steam turbine condensers containing 16,000 tubes in 18 days.

Cost Calculation Example

As an example of the use of Figs. 1 and 2, assume that a process has been developed requiring a heat exchanger of the full floating head type containing 1000 sq ft of surface. Space considerations dictate the use of 16 ft tubes. Fouling is not a problem so that ¾ in. dia tubes may be used. The fluids being processed require carbon steel material on

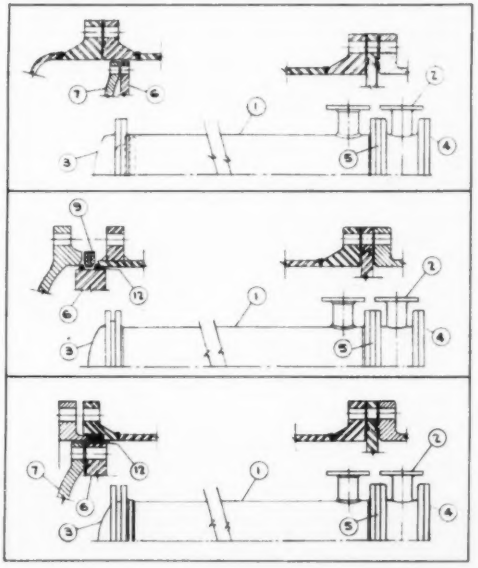


Fig. 4. Internal floating head type commonly used for feedwater heaters. They can be used over a wide range of temperatures and pressures. Cost factor, 1.4

Fig. 5. Packed head type with removable bundle unit commonly used for service as small oil coolers and low pressure, medium temperature service. Cost factor, 1.00

Fig. 6. Externally packed type commonly used for multipass units of large diameter. Much higher shell pressures can be used than with Fig. 5. Cost factor, 1.30

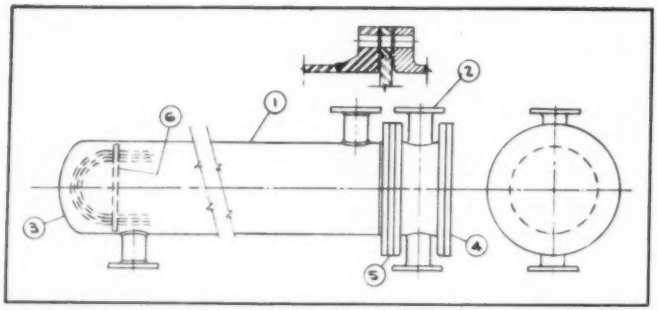


Fig. 7. U-tube type used extensively for small water heaters and liquid-to-liquid service where the tube side fluid is nonfouling. Suitable for multipass designs over a wide temperature range and for either high or low pressures. Cost factor, 0.8

both sides. Design pressure on both sides is 450 psig. The approximate cost of this unit, using data given earlier, would be

$$1.25 \times 2.80 \times 1000 \times 0.94 \times 1 \times 0.85 \times 1 \times 1.4 = \$3910.00$$

The approximate cost of a standard packed head exchanger of 1000 sq ft is $2.80 per square foot or a total of $2800. The installed cost is $4100.00. Installation cost, by subtraction, is $1300.00, so the approximate installed cost of the full floating head unit is therefore $3910 plus $1300 or $5210.00. These figures, when combined with the estimated costs of the other plant equipment can be used in making preliminary surveys regarding the economy and practicability of the process.

Selection and Application

Assuming that the flow rates and terminal temperatures have been established from process considerations, as in the example above, certain general rules as given in Table II can be laid down as a guide to selection regardless of the type of exchanger used.

These are the general rules a designer keeps in mind when laying out an exchanger. The purchaser should determine from physical limitations the maximum length (allowing space for retubing) and the minimum tube size from known fouling conditions. With this information and other limiting conditions, namely allowable pressure drops, the designer can choose the best and therefore the cheapest heat exchanger for the installation.

Sketches and details in Figures 3 to 11 inclusive show construction, arrangements and designs most widely used. The list should not be considered complete, however, for special problems require special solutions and possible combinations are limited only by the designer's imagination and the availability of tube shapes.

In general, removable bundles should be used where temperature variations are large or where shell side fouling conditions are so severe that frequent cleaning will be required. In the case of extreme temperature ranges or multiple pass bundles, a floating tube sheet is necessary so that temperature stresses do not cause the tubes to loosen in the tube sheets.

Figure 3 shows the full floating head split ring exchanger so common in refinery and process work. It can be manufactured in multipass arrangements on both shell and tube sides. Where the shell side is multi-pass and the shell baffles welded in, the floating tube sheet must be made in sections for bundle withdrawal.

It is often cheaper, especially in smaller size units, to use more than one shell because of the expense of welding shell baffles and the loss in shell space due to the extra bolting required for the split tube sheets. These units have a separately bolted floating tube sheet cover and can be designed for any pressure. They are used successfully over wide temper-

(Continued on page 66)

Table II. General rules applicable to the selection of industrial heat exchangers

No. 1. The longer the tube length the lower the cost.

No. 2. The corrosive fluid should be placed on the tube side because an exchanger built with corrosion resistant material on the tube side is cheaper than one using such material on the shell side.

No. 3. If possible, the fouling liquid should be run on the tube side because it is cheaper to clean the inside tube surface than the outside tube surface.

No. 4. For a given allowable space, the smaller the tube size, the greater the installed surface.

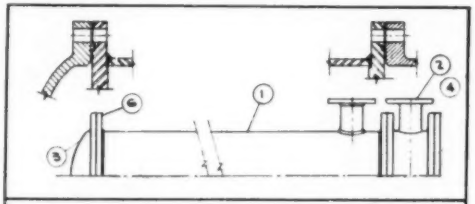


Fig. 8. Welded tube sheet, the simplest of the fixed tube sheet types, best used where temperature change is small. Cost factor, 0.9

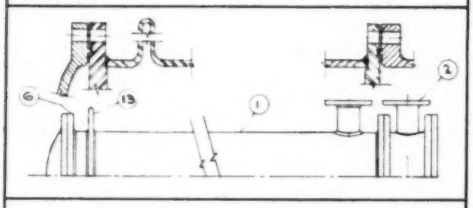


Fig. 9. To take care of larger temperature differences the welded tube sheet (Fig. 8) can be supplemented with a bellows type expansion joint in shell. Cost factor, 0.95

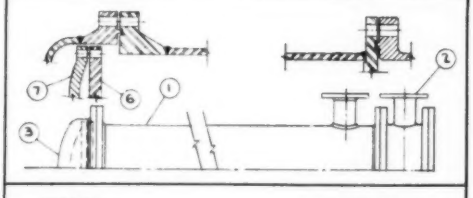


Fig. 10. For large temperature differences and multipass construction the floating tube sheet type is suitable. Cost factor, 1.05

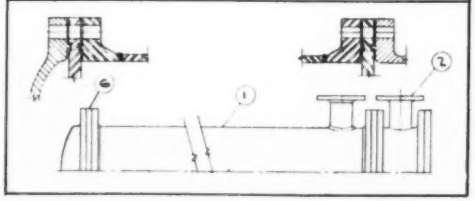


Fig. 11. Another type of fixed tube sheet design with separate tube sheets. Heads and shell may be clad with corrosion resistant material. Cost factor, 0.95

Of Course, MH is PLANT ENGINEERING'S Job!

Engineering, Estimating, Buying, Installing Conveyorized Assembly Units in Metal-Working Plant

By **HERMAN A. SCHARF**, Plant Engineering and Records Supervisor, Sargent & Company

A NEW CONVEYORIZED ASSEMBLY arrangement has been added to the evergrowing number of such units in our plant. A brief resume of what this one has accomplished for the company and for the operators will show why we are proud of the job. There has been a 50 per cent decrease in the number of man-hours required to assemble a given quantity of eleven different models of planes; it has made possible a steady flow of complete units along with better quality and production control and, at the same time, has resulted in less fatigue for the operators. Because of increased storage and more compact space arrangement less handling is necessary which, in turn, has cut down the number of tote boxes and other handling items. Better housekeeping (all departments contend for the Sargent monthly Good Housekeeping Award) is now made easier and is a source of pride to every employee.

In planning this installation all departments concerned joined forces to attain the desired end: a better product assembled more rapidly and at a consequently lower cost.

First, Production Control Engineering decided on the quantity of complete units which were required.

Second, Process and Tool Design Engineering decided the types and designs of tools needed and, when necessary, designed and built them.

Third, Time Study Engineering worked out time standards necessary to synchronize operations for the required production. This involved the development, from elementary time standards, of standards for each operation involved.

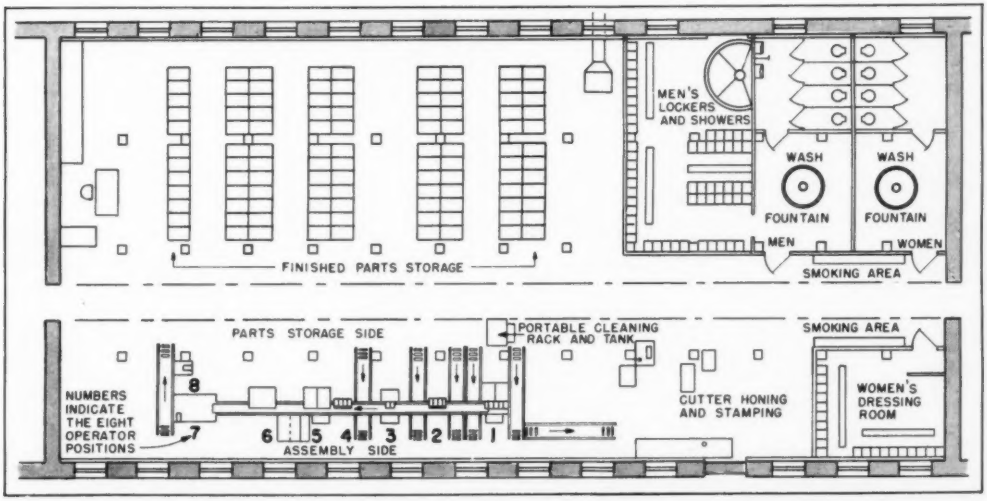
Then came the Plant Engineering Department's job. When the information from Production Control, Tool Design and Time Study had been collected it was turned over to Plant Engineering. It was our job to lay out the department, engineer the assembly requirements, estimate the cost, decide what types of equipment were needed, seek quotations and delivery dates. When this information had been compiled and correlated all these department heads met with the Division Superintendent for the approval of the layout.

The layout was approved so installation was scheduled to begin immediately. The job was made doubly difficult inasmuch as production under the old method had to continue on an uninterrupted schedule and in the same location.

Utmost cooperation of the operators was required because of temporary set-ups of equipment; to assure this cooperation the department head explained to the operators what would take place, where, how and when.

Units chosen for the job were: a Unitized Conveyor Table with a special belt 12 in. wide and 30 ft long with a 6 to 1 variable speed drive; it was built by Island Equipment Corp. Other units, designed and

(Continued on page 64)



Eleven different models of planes can be assembled on the conveyor table in this installation. This well-engineered department is almost sufficient unto itself; it is complete with assembly and storage facilities for the product and has rest, smoking and sanitary facilities for the workers

Modern chemistry has produced materials that will protect you from summer sun-glare, protect your equipment from outdoor exposure, temperature and corrosion, seal concrete walls against moisture infiltration, make cardboard-metal sandwiches. You can use these new materials to fasten conduit to walls or floors, hold wallboard or wall tile in place, install rubber or asphalt cove, put up insulation materials in cold rooms without using metal fasteners, fasten mirrors, cabinets and similar units to walls. Some of them will deaden rattles, squeaks, and vibration

By J. E. GILL
Adhesives and Coatings Div.
Minnesota Mining & Mfg. Co.

Fig. 1. This green, strippable coating protects workers from summer sun glare

ADHESIVES, COATINGS, SEALERS —Their Application in the Plant

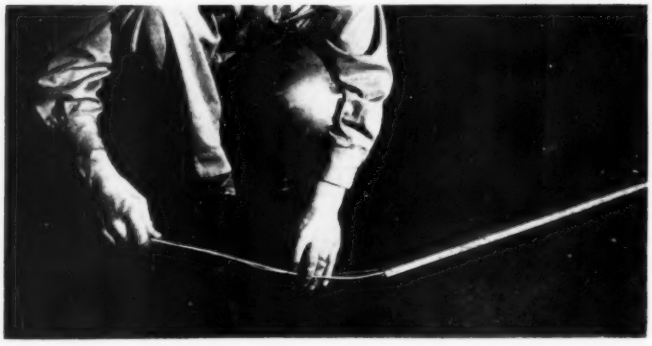
ADHESIVES, COATINGS and sealers permit unique installations and unusual economies in plant engineering and maintenance. Cabinets or conduits can be adhered to metal or concrete walls, for example, without drilling holes or using bolts or screws.

Entire interiors can be finished without mechanical fastenings from the installation of tile and linoleum on floors, walls and ceilings to the laying of cove, the adhering of metal trim, and the application of flexible wood veneer or Vinyl sheeting to walls. See Fig. 4.

Coatings have been developed that can shield metal structures from outdoor exposure, temperature extremes and the corrosive effects of chemicals, solvents and oils. Other coatings offer thermal insulation for motor housings, and acoustical insulation for air ducts, metal stair-

Fig. 2. **Left: Seven large coal hoppers at the Wrigley Bldg., Chicago, receive corrosion and abrasion resisting coatings. Hopper interiors, shown in the photograph, received a heavy, rubber-based, solvent-type coating to protect against both corrosion and abrasion; outside of hopper got a corrosion-resistant coating**

Fig. 3. **Below: Installation of pancake-type Wiremold on a concrete floor eliminates the need for drilling holes in the concrete and thus speeds up the operation. Adhesive is applied in two thin beads with a Plews oiler and the Wiremold is immediately applied to the floor. Preparation of the floor requires only that it be clean and free of grease; normal foot traffic can be resumed immediately**



ways and elevator shafts. See Fig. 2.

Sealers have been created that can shut out fumes, moisture, dust, chemicals and solvents, that can seal metal and other materials despite temperature extremes, shock, and constant vibration.

New in the past six months are products such as these:

. . . **An anti-glare coating** for summertime use on the inside of sun-facing factory windows, applied by spray gun or brush, and removable in the fall by being air-blasted or by being peeled off in a continuous sheet by hand. See Fig. 1. It is resistant to soap and water and to most commercial window cleaning compounds. The coating is a translucent green.

. . . **An improved adhesive** for ceramic tile, eliminating the need for mortar and greatly reducing weight on walls. It is provided pre-mixed, is applied by spatula or notched scraper, and is permanently resilient so that tiles do not crack as buildings settle. See Fig. 5.

. . . **A waterproofing masonry sealer** for use on exteriors of walls. It is applied by spray gun. Synthetic rubber-based, the coating resists heat without flowing and withstands cold without becoming brittle. It is also resistant to the alkali in concrete and mortar, permitting "green" walls to be treated as soon as they are thoroughly dry.

. . . **And a Vinyl coating** for metal floors, decks, walkways, machinery housing, etc., available in a range of colors and in satin or glossy finishes. These coatings are highly scuff resistant to foot traffic and preserve their high adhesion to metal even in the presence of standing water. The sprayable, non-skid metal coating mentioned later is another variation of this same coating.

Also quite new is a heavy-bodied, gray strippable coating which gives temporary protection to non-porous surfaces such as warehoused or outdoor-stored metal, and to such relatively delicate surfaces as airplane wings—protecting the wing during the latter phases of plane fabrication from instrument-installers' shoes. It can be removed by hand or by air blast.

Some of the adhesives, sealers and coatings are competitive with older methods of doing the same job, and of course have to be judged on their relative ability to do the job and on their comparative over-all cost, including both materials and application. Such is the case with certain adhesives when used to perform jobs formerly accomplished with mechanical fastenings such as rivets, screws and bolts.

But many other adhesives, coatings and sealers open entirely new horizons. An example is an adhesive used to laminate metal sheets—a job that cannot be done satisfactorily by older methods of joining materials. In such instances, although both the product and its function may be new, the function may have been long desired, and the adhesive, coating or sealer affords a solution otherwise unattainable. See Fig. 8.

Fig. 4. Installation of linoleum or Vinyl linoleum squares is being accomplished here with a non-vulcanizing, water-dispersed adhesive

For the most part, such products for use in plant maintenance and engineering will be available in containers ranging from 1-pt cans to 55-gal drums. They will usually have a solvent vehicle, but occasionally will be water dispersions, which have the advantage of involving no fire hazard. They will be applied variously by brush, scraper, knife or trowel, and occasionally by spray gun, flow gun or roller. They will usually be air-drying.

They will require little or no technical training in application. Expert judgment, however, is necessary in the selection of the right product for the specific job. Such judgment, of course, is available from either the engineering representatives of the producers or from qualified contractors.

The working difference between the solvent-type and the water-type adhesives lies largely in the better adhesion of the solvent-type to a wider variety of materials, and in its better storage characteristics as

Fig. 5. This new ceramic tile adhesive eliminates the need for mortar thus reducing the weight on the walls. It retains its flexibility permanently so it does not loosen if wall cracks

contrasted with the freezability of the water-type. In addition, the solvent-type adhesive usually has a quick "wet grab," enabling it to get a firm grip almost immediately, while the water-type compound has a slower "wet grab," allowing more time during installation for readjustment of the units being bonded.

Exceptions are necessary to the statement that these products "require little or no technical training in application"—for example, in the use of adhesives for installing acoustical tile: Although the application technique is easily learned, nonetheless the correct procedure is essential to successful installation. As a result, the greatest efficiency and economy are generally achieved by employing a qualified contractor for this type of work.

Wallboard is more readily applied by a plant maintenance crew, with less possibility of faulty application. For most such jobs, the adhesive will be a solvent-type mastic, which may be applied either to the wall or the wallboard by a notched scraper. When thoroughly dry, it will have high resistance to stresses, water and temperature extremes.

Flexible wallboard, which is often so thin that it shows surface irregularities as glaringly as wallpaper, requires a thin adhesive. Both solvent-type and water-type adhesives are used. However, a water-dispersed adhesive is usually preferred, due to its lower initial strength, which facilitates adjusting the position of the wallboard during application.

Wall tile (plastic, metal, glass, ceramic, etc.) for plant shower rooms and in comparable areas requires adhesives which are specially designed to have long life despite alternating hot and cold water, and despite warm, humid air. Different adhesives are necessary to adhere the various types of tile.

Floor tile and linoleum can be used with either a water-type or solvent-type adhesive although the water-type is usually preferred, since a quick "wet-grab" is not essential and it is sometimes desirable to be able to readjust the position of the tile or linoleum during installation. Application is usually by scraper or trowel, and can be by spray gun. Where panel heating, often called "radiant" heating, poses a problem, special adhesives can be prescribed which insure a long-lived tight bond despite a below-floor heat source.

Rubber or asphalt cove installation is usually accomplished with solvent-type adhesives comparable to those used for wall tile, and the application is usually effected with a knife, scraper, or trowel.

Insulation materials bonding in and on walls of refrigeration rooms or compartments is among the multitude of miscellaneous plant uses for adhesives. Since refrigeration engineering is a science of its own, this type of work usually requires supervision by an engineering specialist, although the actual application of the adhesives is simple.

No Heat Transfer Problems

By use of adhesives in such installations, mechanical fastenings and steel members with their attendant heat-transfer problems can be virtually eliminated. An example of such construction would be metal walls, with cork-board for thermal insulation, and cement-and-asbestos sheeting for fire-resistance, all joined with adhesives. Special adhesives, used with notable success in some ocean-going vessels, not only succeed in the bonding function despite constant vibration, but also provide an all-important vapor seal.

Adhesives have also been developed which can secure mirrors, cabinets, boxes and similar units to walls without the necessity of drilling holes for bolts, or employing screws. And other adhesives, used in conjunction with small metal fastener plates, enable the user to mount pipes, conduits, boxes and comparable items on walls, either as temporary or permanent installations.

"Built-ins" constructed by plant crews also invite the use of adhesives for economy and finished appearance. Veneer can be adhered to built-in table tops and desk tops, for example, and plastic and metal drain boards can be installed in kitchens and laboratories, and metal trim can be applied in a variety of locations, all with water-proof adhesives and sealers.

Again, a "prescription" by a trained adhesives engineer or by an experienced contractor is essential to successful use of some of these adhesives. For example, an adhesive able to bond a plastic desk top for office use might not prove satisfactory for a similar job in a laboratory where it would be exposed to chemical fumes. Conversely, an adhesive able to withstand chemical fumes might be unnecessarily costly for a job that does not require such a characteristic.

Sealers and coatings are also important in plant engineering and maintenance. Motor housings and ventilating shafts frequently require both—a sealer to close the joints and shut out dust, fumes and metal particles, and a coating to act primarily as a heat insulator in the case of the motor housing or as a sound deadener in the case of the ventilating shaft. One class of sealers maintains an effective seal even under the heat and stresses caused by spot welding through it.

Sealers are also used to seal plasterboard against vapor transmission, to seal joints between walls and fixtures, and for general maintenance caulking.

The type of coating mentioned as a sound deadener for ventilator shafts is also used for the same purpose in elevator shafts, on the underside of metal staircases, and in similar locations. Usually sprayed on, it is a compound which dries rapidly to a tough, flexible surface; and which is resistant to temperature extremes, shock and moisture thereby inhibiting corrosion.

For other types of metal structures, especially those exposed to chemical fumes, solvents or outdoor weathering, other types of sprayable or brushable coatings have been developed which have high corrosion and abrasion resistance and

(Continued on page 38)

Fig. 6 Toilet partitions, too, are made with adhesives. Sanymetal Products Co., Cleveland, joins 5-ply cardboard filler to metal sheaths. Sandwich construction deadens sounds, makes for stronger construction and uniform thickness

Fight For Lower Freight Rate on Empty Pallets Gains Impetus*

Review of current status of the ever widening struggle for reduced rates on returned pallets . . . Approval of Indiana Docket No. 626 . . . Hearing and approval of Ohio Docket No. 863 . . . Michigan PSC rejects carrier's petition, Docket No. 3094*

By RICHARD H. MORRIS,
Editor, Plant Engineering

WITH THE impetus given by World War II, industry has in the past decade made great strides in the improvement of handling materials within the factory. But not until recently has industry made a real effort to improve the handling of materials between plants. Such progress is only possible, of course, through the full cooperation of all parties concerned: the shipper; the receiver; and the common carrier.

Modern methods require the movement of material in palletized unit loads or in returnable containers for efficient handling by mechanized equipment both in loading and unloading. The greatest impediment to the use of these methods has been the high cost of returning the pallets or containers to the point of origin. Carriers have been reluctant to allow preferential freight rates until it could be proven to them that their savings in manhours and detention time would compensate for the reduced tariff.

However, on October 26, 1948 the Indiana Motor Rate and Tariff Bureau, Inc. approved docket Number 626 which reads as follows:

"Amend Motor Freight Tariff No. 8-D by establishing rates based on one-half of the applicable fourth class rate under 5,000 pounds to apply on Pallets, Platforms or Skids, shipping old (used), also to include necessary separators, sides, ends, stakes or standards, detached, K.D. flat or folded flat, subject to the following general rules. (a) Rates to apply as commodity rates; (b) each pallet or bundle must be marked as to shipper, consignee and destination; (c) minimum charge per shipment 150 cents between certain specified points.

"The proposal was amended to provide for an expiration date of one year from effective date, and that the pallets, platforms, skids, separators, etc., be strapped or tied in bundles, and further that the following be added 'Rates are applicable only on return movement of pallets, platforms, skids and separators which when loaded, moved inbound over the line empties are tendered to.'"

This ruling means that the rate for returning pallets and containers to the original shipper is now one-half of the former rate. The equipment must, however, be returned to the shipper by the same carrier which forwarded the inbound load. At present the rate is applicable only between certain specified cities, but in all probability the tariff will be extended in the near future to all cities in the state. Moreover, the ruling will very likely be amended to permit the return of the pallets and containers by any carrier, instead of being limited to the inbound carrier.

Shippers in Indiana generally supported the proposal, for they are of the opinion that palletized shipments save considerable time both in loading and unloading operations. Tests have proven to them that this form of shipment benefits the carrier by materially decreasing his detention time and releasing cars, trucks and men for handling more freight daily.

Broadening the scope of this new program, a great many carriers are themselves turning to the use of modern handling methods. They have purchased power equipment for handling palletized loads at their transfer stations, and many of them are also palletized L.T.L. loads at their terminals. These programs are at present in the development stage, but during the ensuing year exhaustive studies will be made to ascertain the exact amount of savings to be made by the wider use of the new methods.

On February 4, 1949 a hearing similar to that in Indiana was held before the Ohio Motor Freight Tariff Committee in Columbus, Ohio. Docket No. 863 was approved as follows:

"To publish any quantity commodity rates based on ½ of the fourth class Column A rates, as published in Tariff o. O-1-A, PUCO No. 450, as amended, to apply on 'Pallets, platforms or skids, shipping, old (used), including necessary separators, sides, ends, stakes or standards, detached, K.D., flat or folded flat.' The rates so published will apply only via participating carrier who handled the inbound loaded pallets, platforms or skids.'"

Here again the new ruling approximately cuts in half the cost of returning pallets and containers to the point of origin, notwithstanding that both states have used the highest applicable fourth class base rate. Ohio carriers, like those in Indiana, have confidence in the new thinking. They realize the great advantages in the use of better shipping methods and are willing to cooperate with industry.

In Michigan, however, the situation is somewhat different. While the carriers for the most part are themselves willing to take part in this new program, the Michigan Public Service Commission will not permit them to do so. A number of Michigan carriers appealed to the Michigan Public Service Commission for a docket much like those now in effect in Ohio and Indiana.* On March 8th, the Commission rejected the proposal on the ground that the proposed rates would be non-compensatory to the carrier.

On just what evidence the Commission based its decision is difficult to say, but the fact remains that, for the present at least, Michigan has not seen fit to go along with the advanced thinking in the field of traffic. The only alternative left to the progressive carriers in Michigan is to publish independent rates for specific movements between designated facilities. In addition, of course, there will be considerable movement of freight between points in Michigan and other states, since the I.C.C. permits preferential freight rates on return shipments of equipment. The studies made on such shipments will ultimately prove the value of shipping by pallet or container, and the great savings to be realized both by industry and by the carrier. Test shipments have proven that damage and loss can be reduced by as much as 90 per cent. No further explanation is needed as to what this means.

At present the box-score shows two to one in favor of progress for traffic, but the issue is by no means closed. Traffic men realize that the cost of living is directly related to the cost of production and distribution, and that the cost of production and distribution can be materially decreased by better handling of materials both within and between the factories and distribution centers. Traffic marches forward!

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* This article covers, among other things, the decision of the Michigan Public Service Commission on Docket No. 3094 discussed in detail in the article "Battle for Lower Freight Rates on Empty Pallets Widens" on p 55 of the January 1949 issue of PLANT ENGINEERING. The January article covered the points in the petition and an anlysis of data submitted on its support. The Commission decision, 4 pp on legal size paper, was made March 3, 1949.

Preventive Maintenance Program — ELECTRIC STORAGE BATTERIES

By K. A. VAUGHAN,
Manager, Field Engineering,
Gould Storage Battery Corp.

Causes of battery failure . . . Battery record system and its advantages . . . Preventive maintenance as a job for well-trained personnel . . . Handle battery properly when removing from truck . . . Use approved-type water when refilling cells . . . Do not overcharge . . . Or over-discharge . . . Take individual cell readings at regular intervals . . . Keep batteries clean to prevent current leakage and vent plugging

MAINTENANCE is one of the few remaining departments where cost can be reduced. Very little effort has been made to control maintenance costs other than by the reduction of maintenance personnel; this is not the complete answer.

The ideal type of maintenance is preventive maintenance. This must be controlled by supervisory authority especially in the general overall picture. Preventive maintenance is by far the cheapest. Not only does it extend the life of equipment, it also reduces lost time due to equipment failures which in the case of motive power batteries tie up the entire material handling system.

In battery-operated equipment the battery probably requires the least maintenance if that maintenance is properly supervised. Following are the main causes of battery failures:

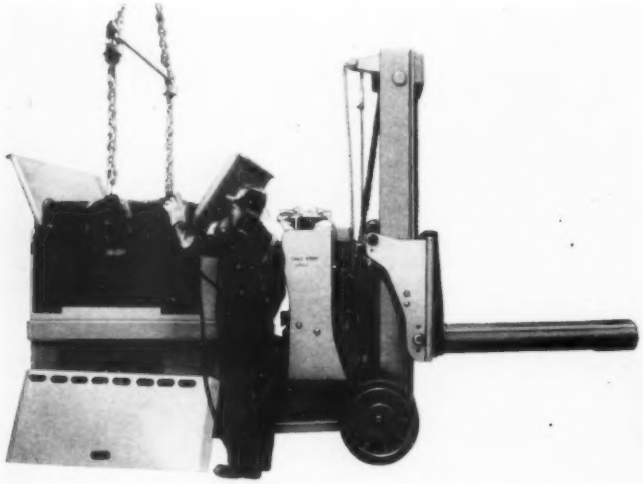
Improper Charging. 1. Failure to give the battery sufficient charge, after each discharge, reduces the duty cycle. 2. Overdischarging increases the time required to bring the battery to a full charged condition. This disrupts the entire battery charge system.

Failure to repair damaged cells. 1. This reduces the efficiency of the battery by reducing total voltage. Result: loss of speed and power. 2. Increases the drain on cells in good condition. 3. Damaged cells or cells removed from the circuit increases the finish rate of the battery on charge and tend to damage the positive plate of the good cells. 4. Damaged or removed cells lower the voltage of the entire battery. This is harmful to the motor of a vehicle under heavy load. 5. Failure to periodically wash batteries allows external short circuits to build up across the top of the battery reducing its efficiency.

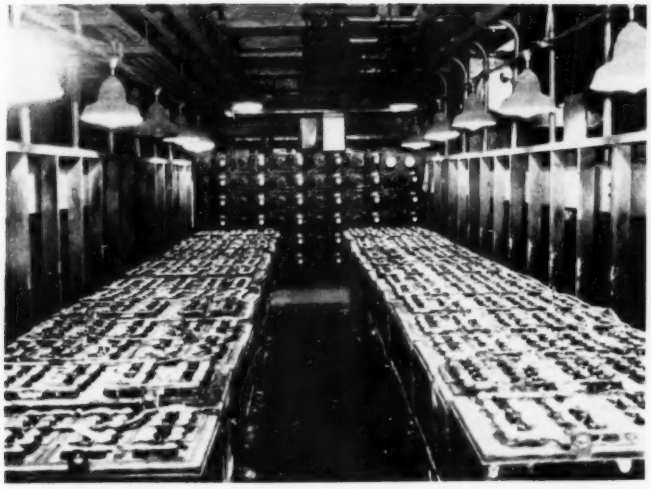
Battery Record System

There are various methods or systems used to control battery maintenance and one of the best is the daily battery record system as follows:

1. Each battery is numbered.
2. As each battery is installed in the vehicle the specific gravity and temperature is read and recorded, time the battery is put into service is recorded, and the vehicle to which it is assigned is recorded.
3. When a battery is returned to



● Fig. 1. Left: Never lift the battery by the terminals. Always use lugs provided at each end of the battery. Terminals will not support the weight of the battery and will be damaged if batteries are lifted by them. Also, in lifting batteries, never use a simple sling but always employ a spreader equal to the length of the battery. A spreader causes the weight of the battery to be supported in a perpendicular direction and reduces the bending or twisting of the tray. Bending or twisting resulting from the use of a simple sling may cause cell damage. ● Fig. 2. Right: Evaporated water must be replaced periodically. Distilled water or manufacturer-approved water should be used, since many waters contain minerals harmful to battery efficiency and life. The level of the electrolyte should be above the top of the plates of the battery but not high enough to cause splashing during charging. (During charge, the electrolyte will gas and bubble and, if the level is too high, it will spill over the battery top). Replacement of evaporated water will vary considerably as the rate of evaporation is entirely dependent on prevailing cycle and operating conditions. To be safe, it is well to check the height of the electrolyte in the battery at the end of each discharge



● Fig. 3. **Left: Batteries should be charged according to the instructions of battery manufacturers. Constant overdischarging seriously decreases the life of the battery. Overcharging should be avoided because the excessive gassing which results is detrimental to the plates of the battery. Charging within ten points of the fully-charged specific gravity after each cycle, and establishment of periodic equalizing charges, results in longest battery life and most efficient operations. An equalizing charge is an additional charge equal to about 25 per cent of a normal charge at the finishing rate. The correct finishing rate (low charge rate used when the battery is nearly charged) is supplied by the manufacturer.** ● **Fig. 4. Right: Individual cell voltage and gravity readings should be taken at least once every three months and preferably once a month as part of a regular inspection program. These readings should be recorded. When an individual cell falls below 0.10 v of average of other cells, equalizing charge is necessary**

its charging station the specific gravity and temperature is read and recorded, time is recorded, and the setting of the ampere hour meter together with a note as to whether evaporation was replaced or not is also recorded. A sample record form is shown in Fig. 8.

A quick glance at a chart of this type will give the supervisor the following facts:

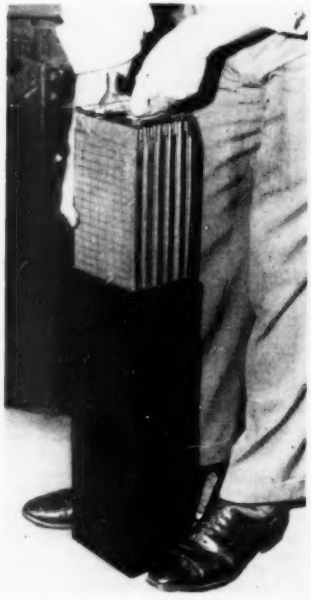
1. Whether the battery receives sufficient charge before being placed in service.

2. The number of hours the battery actually was in service.

3. Whether the battery was discharged below normal value.

4. A comparison of the specific gravity as read at the end of the discharge compared with the ampere meter setting and the ampere hour meter chart will tell whether batteries are being properly charged.

● **Fig. 5. Left: Batteries require cleaning from once a day to once a month depending upon the conditions under which they are operated. Cleaning prevents: 1. current leakage across the top of the battery and grounds to the truck body and 2. the possibility of the vent caps becoming blocked under dusty conditions. Water or compressed air can be used in cleaning; water should be carefully dried to prevent current leakage. Arrangements should be made periodically to wash the battery with soda and water to neutralize any acid that may have spilled on the tops or sides**



● **Fig. 6. Damaged batteries should be repaired at once. A damaged cell overtaxes the other cells besides having an adverse effect on charging by increasing the finish rate. Damaged cells should never be cut out of a battery. Repair them and return them to the circuit before placing the battery back into service. Battery manufacturers distribute complete instructions and some give training courses on how to remove, repair, replace damaged cells**

● **Fig. 7. Above: Hydrometer readings giving the specific gravity of the electrolyte should be taken on at least one cell of the battery at the end of each charge, and also at the end of each discharge. Some operators establish a procedure of taking pilot cell readings of batteries in operation once every 4 hr. These readings indicate the amount of charge that has been used and supply a basis from which an estimate can be made of how much work is left in the battery**

From a chart of this type a definite procedure can be established whereby batteries may be changed in time to prevent overworking. Thus, the efficiency of the vehicle is increased and there is no lost time due to battery failure during the duty cycle.

This chart also tells whether a battery was in full charge condition before it was placed in service. Failure to give a battery sufficient charge will result in battery failure during the shift.

The temperature reading of the battery before being placed in service will indicate whether the proper charge rates are being maintained; high battery temperature is a warning that the charge rates are too high. Cells cut out of the circuit, or leaking or broken jars which have caused the battery to become short circuited may be the reason for high charge rates.

Floating Battery Man

Some plant engineers appoint what might be considered a "floating" battery man who is equipped to test batteries on the job. He visits all workings, checking the batteries while they are in service. Due to his experience he can tell approximately when the battery should be returned to a charge station. This is rather an expensive way of doing it but it gives an excellent opportunity to check up on charging conditions.

Under no condition should production men be put in charge of preventive maintenance. Experience has taught us that they have very little regard for equipment. Their main goal is to get production at any cost; furthermore, they have no responsibility for the cost of maintaining equipment.

Preventive maintenance of storage batteries must be started the day the battery is unpacked. Every man charged with the operation of the battery should be made thoroughly familiar with the manufacturer's maintenance recommendations and these should be followed to the letter. Battery companies maintain a service organization which is available at no cost, for the purpose of instructing plant engineering personnel on proper battery care, and on making repairs to equipment damaged in service. Such service organizations cannot be available to make all repairs so it is advisable for the plant engineer to assign a responsible man, who after training, will be able to carry on unassisted, to take instructions from the field engineer.

Adhesives

(Continued from page 34)

which may serve as a finish coating in themselves. These, too, are usually solvent type compounds, applied by spray gun or brush.

An example of such corrosion-inhibiting coatings is a spray-on or brush-on coating which has a solvent vehicle, and a base consisting of a combination of synthetic resin and synthetic rubber. It is used to protect interiors of oil tanks even in sour crude fields, and is employed as an anti-corrosion coating on power transmission towers, fractionating towers, cranes and on structural steel. It can also be used to protect water tank interiors against rust when the water is not for human or animal consumption.

Also important in plant maintenance and safety engineering are non-slip coatings for floor areas, or adhesives for applying non-slip floor coverings. The adhesive used with such coverings is usually applied by brush and is sold with the non-slip surfacing material with which it is to be used. One type consists of toughened fabric cleats which have a coating of hard mineral grains. The cleats are installed with a specially-developed adhesive. Liquid coatings which incorporate non-slip properties are usually applied by spray gun or brush, and are especially valuable for irregular areas, contours or temporary flooring of any kind. The grits used in sprayable coatings are non-sparking—important where there is a fire hazard.

STORAGE of lumber or wood products in a yard with an earthen surface has to contend with fungus growths and insects. The remedy is to treat the earth with a chemical to a depth of from 12 to 18 in. There are a number of these chemical preparations on the market.

BATTERY RECORD

Day Operator _____ Night Operator _____ Date _____

Battery Number	Charging										Put in Service			Returned			Remarks:
	Started					Finished											
	Date	Time	Amps	Temp	S.G.	Date	Time	Amps	Temp	S.G.	Date	Time	Truck No.	Date	Time	S.G.	

● **Fig. 8. Keep accurate records of all charging and maintenance operations. These records enable the plant engineer to: 1. Know which batteries are being abused or are wearing out and he can then take corrective or replacement measures, and 2. diagnose troubles in operating equipment, and charging schedule. In addition, maintenance men are more conscientious when required to keep records because it upgrades the entire operation**

SELECTION, USE AND CARE OF TOOLS

Hammers—They take a lot of beating

By THOMAS TRAIL

HAMMERS ARE TOOLS that are much used and, because of their apparent ruggedness, much abused everywhere. The principal type of hammer employed by mechanics is the ball pein or machinists' type. This hammer is made in a number of sizes ranging from 2 oz to 3 lb. These sizes are also given numbers. The 2 oz is 7/0, the 3 oz is 6/0 and so on to the 1-lb hammer, which is 0. Beginning with the 1-¼ lb hammer, the sizes run from No. 1 to No. 8, the latter being the size number for a 3 lb hammer. Machinists' hammers are made in straight pein and cross pein styles also, but these are little used in ordinary work.

Of course, not all hammers are of the same quality, quality depending to a great extent on the steel of which the heads are made and the type of wood used for the handles. The best hammers are made of high grade tool steel and have straight-grained, well-seasoned hickory handles.

Importance of Details

In choosing a hammer, note whether the head is well designed and of properly balanced shape. Check the handle for straight grain and freedom from cracks, knots, splinters or any other imperfections. Sight toward the head to determine whether the handle is straight and has been set in the head accurately. Also examine the wedges and see that the handle can be retightened if necessary after use. Lastly, see that the handle is relatively slender near the head, so that it will absorb the shock of blows struck.

For general use in the average shop, the 12 oz, 1 lb, 1½ lb and 2 lb hammers will take care of most work. Another type of hammer popular with mechanics for heavy work is the engineers' cross pein, Fig. 1, or the engineers' double face, Fig. 2, patterns. These hammers are ideal for driving machine parts, large masonry drills or chisels, etc. The cross pein type is made in 2, 2½ and 3 lb size, numbered 2, 3, and 4 respectively. The double-face pattern comes in two sizes, 2½ and 3 lb, numbered 2 and 3 respectively.

Usually, some wood working is required in most shops, thereby necessitating the use of a nail hammer. While high quality is not absolutely necessary in such a tool because of its infrequent use, little is saved by buying an inferior grade.

Get Right Type for Job

Nail hammers are made in two general patterns, curved claw (semi-ripping), Fig. 3, and straight claw (ripping), Fig. 4, the former type being the most popular. Weights range from 13 to 28 oz and are numbered from 2 to 0 respectively. The 16 oz. No. 1½ size, hammer is a good weight for general use.

For riveting, working in corners and for other special jobs, machinists' riveting hammers, Fig. 5, are very useful. These hammers are made in head weights of from 4 to 18 oz, and are numbered from 0 to 5 respectively. For most ordinary shop use a 7 oz, No. 1 and 15 oz No. 4, will be found adequate.

To take care of extra heavy hammering of heavy machine parts, heavy drilling, masonry breaking, etc., a blacksmiths' sledge, Fig. 6, is quite indispensable. The double face pattern is the most practical for general use. These hammers have long handles and are made in head weights ranging from 2½ to 20 lb. The 8 lb weight is ideal.

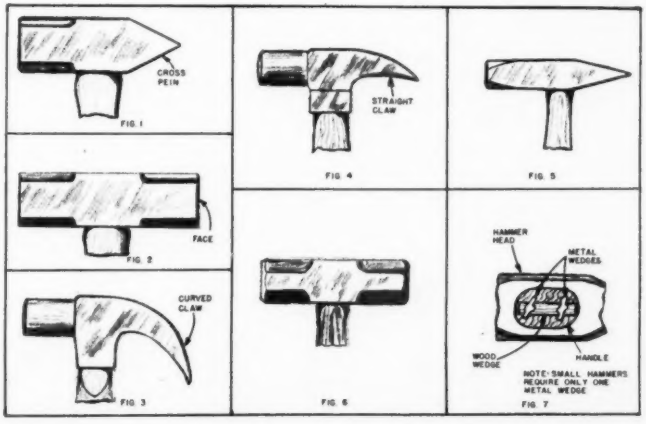
Several other types of hammers are available, each designed for a particular type of work, but these are of limited use and should be selected only where need for them exists.

Hammers, while of sturdy construction, are not indestructible. Care should be taken not to use hammers that are regularly employed for use with tools in work that will damage their faces. Avoid striking the handle or throwing heavy objects on it as this may splinter or crack it. Never use a hammer or its handle as a pry, and always see that the handle is tightly wedged before using the hammer.

Physical effort will be conserved if the proper size and type of hammer is selected for the job at hand. Using too light a hammer wastes motion; while a hammer that is too heavy overtaxes the muscles.

When replacing a hammer handle procure the best grade available. It takes just as long to fit an inferior handle. Remove the old handle and clean out any chips left in the eye of the head. Then carefully shape the handle to a tight, full fit, using a plane or draw knife for the purpose. Sandpapering may be necessary for the final fit. Then drive the handle solidly into the head by holding the hammer head up and bringing the opposite end of the handle sharply down on a block of wood. The weight of the head will drive it onto the handle. Cut off any handle material projecting through the head and remove any chips from the handle. Split the end of the handle slightly with a broad wood chisel, drive in a thin hardwood wedge, and drive two metal cross wedges in place, as shown in Fig. 7.

Hammer heads should be occasionally wiped with a slightly oily cloth to prevent rusting. A hard wax finish applied to the handles will help prevent warping in damp weather.



Selection of the proper type and correct weight of hammer can result in a job being completed more rapidly and cut down on fatigue of the mechanic

Color and the Cash Value of Accidents

By **FABER BIRREN**, Industrial Color Consultant

A factual report on the application of a color code and a coordinated safety program to 38,000 workers . . . Practical aspects of industrial color vs emotional appeal . . . Two case studies . . . The color code in relation to color blindness . . . Saving of $500,000 in one case alone

PRACTICAL benefits of color in industry are beginning to be apparent. The novelty of a resplendent factory has run its course, for the advantages of color are being demonstrated through scientific studies and case histories. The use of color or music or any such emotional stimulant should, in the American system of business, favorably affect profits or savings. Any fanfare, such as color, must have a practical basis and not alone bring delight to employees.

A few years ago color was brought into industry to perform a number of functional tasks. With it, lighting was to be improved and eyestrain relieved. A better working environment was to increase production, promote good labor relations, reduce absenteeism and accident frequencies. Probably much has been accomplished. This, however, is not always easy to determine. In a survey conducted by the National Industrial Conference Board, some 350 organizations reported experience on the use of color.

"Few statistics are available on the use of color in industry, and many of these companies were unprepared to evaluate their programs because of the difficulty in measuring the effects of a service as intangible as color."

Findings of the report, therefore, had to be concerned largely with generalities: 33.8 per cent were "entirely satisfied"; 41.2 per cent "well satisfied"; 4.4 per cent "not very well satisfied"; 1.5 per cent "not at all satisfied"; and, 19.1 per cent had "no opinions" to offer.

Yet color in industry gains acceptance. Intangible or not, its use increases with time. Being visually impressive if not statistically so, color holds a definite fascination and stimulates a sort of inner-conviction that it must be good because it looks so appealing.

Fortunately, some users have tempered credulity with research. The Public Buildings Administration and the U. S. Public Health Service have recently published the result of a 2 yr study. An office in the Bureau of Internal Revenue was newly relighted and all walls and equipment refinished in tones of green and gray. Although the tasks of the employees changed somewhat during the course of the experiment, researchers found reason to conclude that production rates increased from 5.5 per cent in some instances to 37 per cent in others.

In cash value, a 5.5 per cent production improvement has been equivalent to a saving on gross payroll of $13,229.00 among some 95 government employees. Because this figure is a credible one, it may be stated, from this experiment at least, that right illumination and right color have been worth about $139.25 annually per employee. American industry may well use color to advantage and profit in cases where light levels and color effects are below standard.

Controlled tests of this sort have not been made. The emotional factor in color all too frequently leads to prejudiced conclusions. Industry understands this but seems willing to enhance the working environment without having specific data to justify painting costs. Simply, the plant looks so much better.

Production and morale are difficult to measure. Yet there is one rather sure check on the value of color. This is in the field of safety and the objective record of accident frequencies. Lost-time accidents are necessarily a part of business accounting. They have cash values in payments for compensation, medical service, lost production and the like. Industry knows the price of injury and has a good knowledge of it.

Fig. 1. Left: A light blue is standard for switches, control boxes and controls in general so as to have these devices clearly defined but yet not be too distracting to the eye

Fig. 2. Below: Black and yellow stripes are standard for shop trucks and low beams. This combination has maximum visibility even in dim light

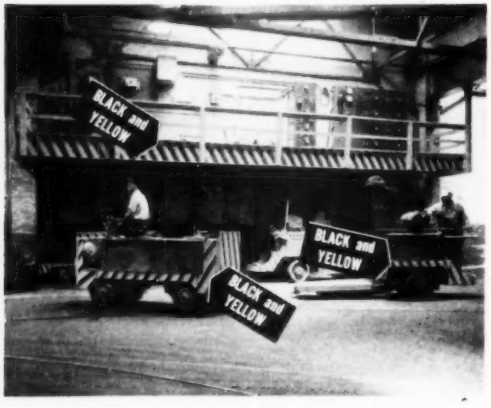


Fig. 3. Brilliant orange, the color of greatest attention-value, is applied along cutting edges to concentrate the attention of the worker and invite caution

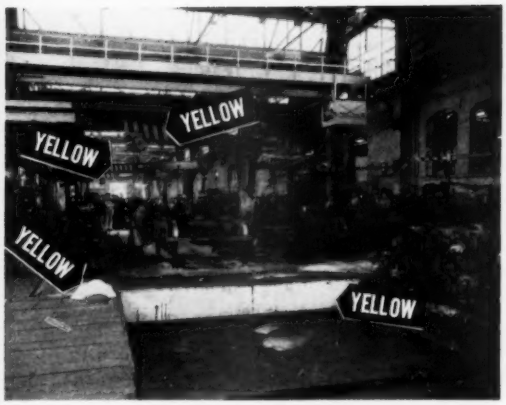


Fig. 4. Crane hooks, the tops of jib cranes, pit and platform edges have light yellow. This is a color readily seen even by the 8 per cent color-blind males

Hence the story of color as applied to the shops of the New York City Transit System may be accepted, without emotional prejudice, as a fair and reasonable evaluation. During the winter of 1946 an exhaustive study was made of the facilities, equipment, machines, operations and accident hazards of all shops. From this analysis a standard color code for safety practice was developed.

YELLOW has been employed for so-called strike-against, stumbling and falling hazards, for crane hooks, projections, car stanchions, pit edges.

ORANGE is used to mark the dangerous parts of cutting and forming devices, exposed rails and wires.

BLUE (as in the railroad industry) is used to mark equipment down for repair. It is specified for switch boxes and controls in general to assure caution.

GREEN is used to mark first aid cabinets, stretchers, gas masks.

RED has been reserved exclusively for fire protection, and for nothing else.

This color selection, originally worked out by the author in 1943, respects established traditions but has been scientifically checked to make allowance for the high frequency of color blindness, about 8 per cent, among men. The most vital colors, yellow, orange and blue, were all found to be readily distinguishable by the average color-blind person.

The code was published by Du Pont in February of 1944 and later was adopted in substantial part by the American Standards Association (July, 1945). It has since been broadly applied by American industry and is mandatory in all shore establishments of the U. S. Navy.

The program of the New York City Transit System was put into effect during the early part of 1946. So that its benefits might be quickly applied, union permission was granted to let the workers themselves wield paint brushes. Men familiar with special equipment and machines, and with shop hazards, became painters. Within a short period all shops had been thoroughly rehabilitated. The work was carefully checked to assure consistency.

With the color plan as part of the accident prevention program of the Board of Transportation, the Safety Department also initiated a supervisory training program. Foremen, assistant foremen and supervisors are today being given a ten-week course in safety practice. Two-hour classes are conducted for which the men are paid and for which they receive a certificate signed by William Reid, Chairman of the Board. Similarly, a course in first aid, designed to train all employees, has also been undertaken.

That the resourceful use of color and proper safety training will pay real dividends may now be dramatically stated from the experiment. *Accidents in the shops of the New York City Transit System began to fall off at once. Eighteen months after the introduction of the color code they had dropped 42.3 per cent.*

This, of course, has had its humanitarian aspects in fewer injuries, broken bones, sprains and amputations. Yet to management it also has a mighty favorable dollar value.

Accidents are costly. Among civilian employees the Federal Government values them at $1,044.00 each. *Using reliable figures and applying them to the 38,000 employees of the New York City Transit System, a 42.3 per cent reduction in lost-time accidents is equivalent to an annual saving in excess of $500,000.00.* The program, in fact, has exceeded most expectations. Its benefits have been far reaching indeed and will undoubtedly offer a real contribution to the general field of safety.

The accident problem, however, is not to be solved by color alone. It is no substitute for physical guards, for a training program that forcibly impresses right discipline.

Yet to the great credit of color is the fact that it creates visible symbols and reminders. The brightness and appeal which it brings into industry makes any hazard a more or less cheerful thing to behold, one which has an emotional impact to it and therefore is not easy to forget.

In the New York City demonstration, the fact that color has been put to use is apparent on sight. Because it has been placed about in shops to distinguish hazards, not for any purposes of decoration, it shouts no cries of wolf. Where it catches the eye it does so with serious meaning.

Today safety instruction among supervisors and workers has taken on greater significance, thanks to color. Management in inspecting its plants may see what has gone into the price of a coat of paint. Back at headquarters it may likewise study its accident-frequency reports and calculate savings. For through color a splendid contribution can be made to business economy and to improved industrial and human relations.

Have Your Color Questions Answered by an Authority

FABER BIRREN, a pioneer and outstanding authority on color in industry, has agreed to answer questions on this subject for the readers of PLANT ENGINEERING. This service is offered without charge to promote better color practice, encourage standardization and avoid misapplication. Address Color-In-Industry, Editorial Department, PLANT ENGINEERING, 53 West Jackson Blvd., Chicago 4, Ill.

The Vacuum Pump—Its Cost and Use for Industrial Processing

Range of vacuum requirements . . . Rough and fine vacuum . . . Single and two stage reciprocating pumps . . . Proper use of intake condensers . . . Rotary pumps and oil separation . . . Two stage separators . . . Steam jet ejectors, adaptability and accessories . . . Final selection on the basis of versatility, investment and maintenance

By **NOEL R. MALEADY**, Works Laboratory, General Electric Co., Pittsfield, Mass.

WIDE APPLICATION of the vacuum pump for simplifying many production problems makes a knowledge of the basic vacuum producing equipment of primary importance. Each of the several types of equipment has its own field of effective operation. Attempts to use one type of pump for every application may result in unnecessarily high investments, gross inefficiences, and high maintenance costs.

Without attempting to detail conditions involved in specialized vacuum-pump applications, such as 'dry' and 'wet' vacuums as used in vacuum tube work and paper making, some generalizations of the field as a whole can be drawn on such subjects as drying, dehydration, deaeration, and similar applications.

In these fields of vacuum applications, a wide range of gas pressures may be involved. Roughly these operating ranges can be divided into two classifications: rough vacuum from 25 to 29 in. Hg as referred to a 30 in. barometer; and, fine vacuum from 29 to 29.9 in. Hg or roughly 1 to 25 mm Hg absolute.

Mechanical Vacuum Pump—Rough Vacuum

When operating within the range of 25-29 in. vacuum, the simple, single, or two-stage reciprocating pump proves to be excellent. It possesses relatively high pumping capacities (1500 cfm) at these pressures with relatively little floor space. The secret of a well designed installation, involving such a pump, is the addition of a suitable surface condenser in the pumping line ahead of the vacuum pump.

Such an arrangement permits handling of moderately large quantities of water or solvent vapors, with no danger to the pump. Only air, saturated with water vapor at approximately the temperature of the condenser cooling water, reaches the vacuum pump. The danger of harmful 'slugs' of liquid reaching the pump has been eliminated.

Without the use of the air condenser, the load on the vacuum pump is increased unnecessarily, due to the higher vapor temperature and concentration (e.g. in drying operations), and the pump may be seriously damaged by condensed water which may rupture the cylinder, damage the piston or bend the rod.

Closer analysis of the rough vacuum range, 25-29 in., indicates that the choice of single or two-stage reciprocating pump depends upon the exact operating pressure. Existing efficiency data for the two pumps shows that the single stage unit will operate effectively to 28 in. vacuum only. Where consistent use of vacuum from 28 to 29 in. is required, cost and efficiency data show that the two-stage pump, while not processing high capacities of free air, operates more efficiently.

To illustrate this point, Fig. 1 shows a plot of a typical reciprocating pump, operated as a single and two-stage vacuum pump with the purchase cost per cfm vs the operating pressure. While the single stage pump shows remarkably low unit investment cost up to 26 or 27 in. (below $4.00), unit costs for the two pumps became comparable at about 28 in. On the other hand, the two-stage pump maintains a reasonable cost ($7.00 per cfm) to about 29 in. vacuum.

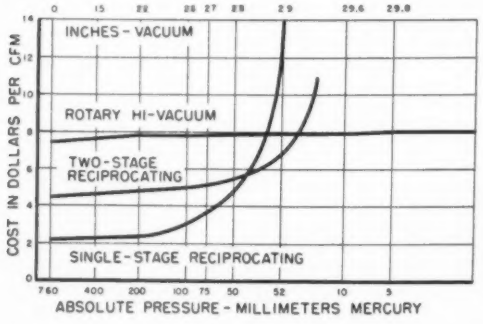

0 15 22 26 27 28 29 29.6 29.8
INCHES - VACUUM
ROTARY HI-VACUUM
TWO-STAGE RECIPROCATING
SINGLE-STAGE RECIPROCATING
COST IN DOLLARS PER CFM
0 2 4 6 8 10 12 14
760 400 200 100 75 50 52 10 5
ABSOLUTE PRESSURE - MILLIMETERS MERCURY

Fig. 1. Equipment costs of various types of vacuum pumps showing variation of unit capacity cost as a function of suction pressure

Fine Vacuum

In the field of fine vacuum, that is below 29 in. or from 1 to 25 mm. absolute pressures are involved. In this range, the rotary-type pump is well adapted, as comparative costs of Fig. 1 indicate. Using a suitable precooler (surface condenser) this type pump can be made to handle reasonably large amounts of condensable vapor.

Assuming adequate condensing surface in the vacuum line before the pump, it is still necessary to handle moderate quantities of water at the vacuum pump. Recognizing this fact, the selection of the best pump should depend, other things being equal, on its abiltiy to handle reasonable quantities of condensed water. A satisfactory pump, therefore, should rotate at reasonably slow speeds to prevent emulsifying the condensed vapor with the vacuum pump oil. It should also have a sufficiently large and well-designed oil separator to permit gravity separation of the water and oil.

Vacuum pumps with insufficiently large oil separators must depend upon integral steam or electrically heated vaporizing plates to free the vacuum pump oil from included water. Even this may not solve the problem, in fact sometimes may tend to aggravate it so that quantities of

vacuum pump oil are carried out through the discharge.

An excellent solution to the problem of water-oil separation may be found in a design where the separation of the exhaust air and oil is handled by one well-designed oil separator, and the separation of the water and oil mixture by a second separating chamber. In this system, air, oil and water vapors, from the discharge valve of the pump, first pass through the upper separator, where the air is separated from the liquid and then discharged from the system.

This separator is designed to provide ample space between the top surface of the lubricator and the baffles to allow free passage of the air without agitating the oil-water mixture. This minimizes the possibility of emulsifying the oil. The mixture of oil and water then flows to the base of the pump, where natural separation takes place by gravity.

Checking the Oil to Maintain Viscosity

Here the mixture is not agitated by air currents, and thorough separation is assured. The oil is filtered and returned to the pump bearings and interior. An automatic overflow drain discharges the excess water continuously and automatically, while the pump is in operation. Clean air is exhausted from the top of the separator.

Assuming then, satisfactory separation of condensed water from the vacuum pump oil, the main objection to this type pump for dehydration work has been eliminated. However, as the efficient and successful operation of the pump depends on maintaining the proper quality of oil, this then becomes a primary consideration in actual operation.

In most systems, small amounts of volatile contaminates reaching the pump gradually dilute its lubricating oil, but this condition can be easily gauged by periodic check of the viscosity of this oil. The adoption of reasonable limits, say up to 50 per cent lowering of viscosity will assure adequate lubrication and consistent, trouble-free performance.

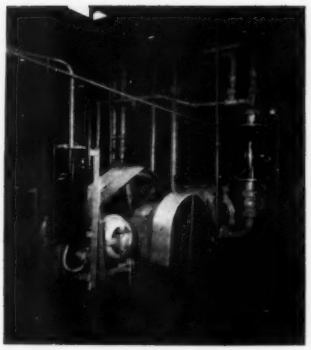


Fig. 3. A two stage reciprocating vacuum pump on drying equipment

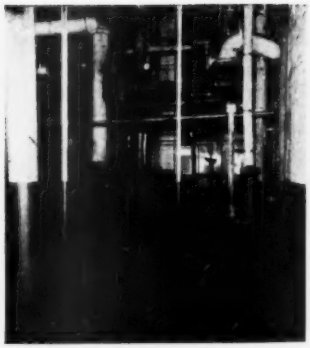


Fig. 4. A three stage hydro-steam ejector on an impregnation installation

One type of vacuum-producing unit which can be purchased for operation in any range of vacuum from 25 to 29.9 in. is the steam-jet ejector. Unlike the mechanical pump, however, the ejector is especially designed for the particular job and capacity which it must handle. Jets of four or five stages are producing vacuum well below 1 mm. in actual practice.

Steam-Jet Ejectors and Their Related Equipment

For economy, the steam ejector is normally supplemented with a suitable barometric condenser and hot well. It normally requires moderate floor space plus considerable mounting for the jets, and of course necessary head room for the barometric condenser. On the basis of first cost, the steam jet has considerable advantage over the mecahnical-type pump.

The disadvantages of the steam ejector over the mechanical pump are few, but may nevertheless be the deciding factor. The requirements of adequate head room, constant steam and water pressure, plus super structures for mounting the jets, may many times swing the balance in favor of the mechanical pump.

However, certain other factors which may have acted against the choice of the jet pump can be traced to the lack of a thorough understanding of the exact mounting, pipvantage over the mechanical-type cases have developed where the poor operation of a jet pump can be traced to untrained operators, careless installation, or, on occasion, incorrect jet design. The best solution to this problem is to present the whole evacuation problem to a reliable jet manufacturer.

To summarize, it may be said that on the basis of actual operating experience, the quality rotary vacuum pump provides a satisfactory compromise of versatility, investment cost and maintenance. In systems where constant process development makes standardization of operating conditions difficult the trend is towards increasingly higher vacuums. To supply this flexibility of operation in wide ranges of vacuum, the relatively constant volumetric efficiency of the rotary vacuum pump provides a distinct advantage.

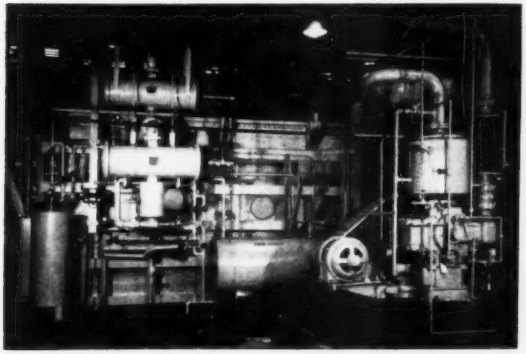


Fig. 2. Rotary high vacuum pump (at right) on a high vacuum drying process. Note, glass suction entrainment separator

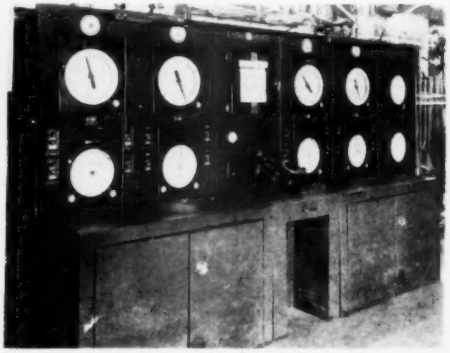


Fig. 5. Typical instrumentation on a large central control panel for a vacuum drying installation

Photographs: United Air Lines

Fig. 1. Above: Here is an engine bath that lasts for 5 hours. Engine cylinders are shown entering the 160 ft washer tank where they will be scrubbed clean in 30,000 gal of special detergent solution activated by a series of washers and pumps distributed through the tank's length

Fig. 2. Top, Right: For thorough inspection of steel parts the maintenance base uses this Magnaflux machine. In the process, 1500 amp. d-c current are passed through the part which then is sprayed with ultrasene which contains a cast-iron compound. Any defect in the part then is revealed through the adherence of this paste to the two poles formed by the concentration of forces around the flaw. After inspection, the parts are de-magnetized

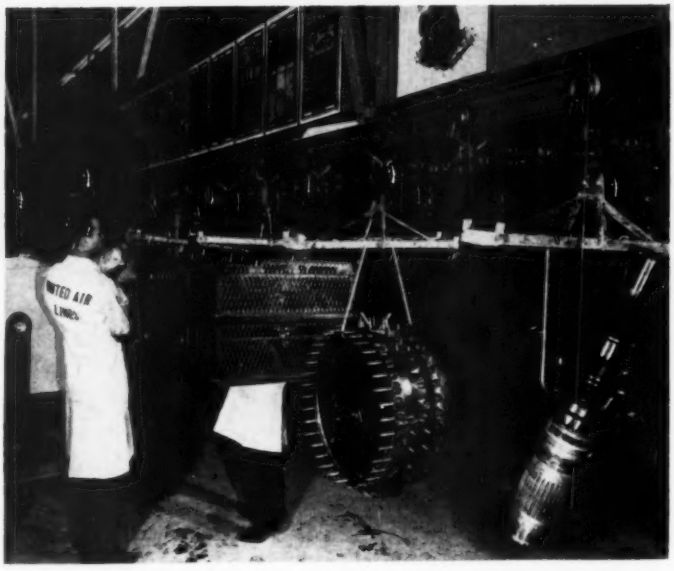


Fig. 3. Disassembly of the giant Pratt & Whitney engines for cleaning and overhaul is like unwinding a ball of twine. Piece-by-piece the engines are taken apart and placed on the overhead chain conveyor. The diagrams above the conveyor show the arrangements for various parts in the metal baskets

Washing 1,000,000 Horses

A UNIQUE and highly important feature of the new United Air Lines' maintenance base is the 160-ft long engine washing tank which is shaped like a hair pin. When the engine is wheeled into the shop it is given a quick steaming and then is disassembled—first the reduction gear; next, the cylinders, crankcase and main case assembly. Last is the rear intermediate section, diffuser, rear support plate, rear accessory section, front support plate and main crankcase. The one million horsepower of United's 600 engines are cared for here.

The large parts are fastened to 1280-ft long overhead endless chain conveyor. Others are put into metal baskets. Two 1½ hp electric motors drive the conveyor at speeds varying from 9 to 27 in. per minute.

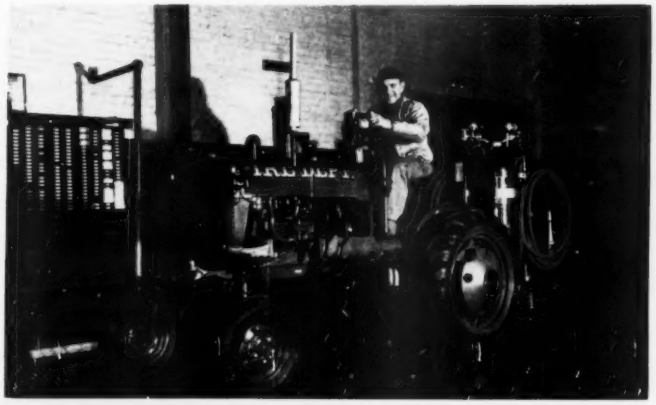
A few minutes after the parts are loaded onto the conveyor the chain turns a corner and dips down into the entrance of the long tank.

Steel parts are put through a Magnaflux process in which metal filings, drawn by powerful electric currents, form a pattern around any flaw no matter how infinitesimal. Delicate gauges and micrometers measure tolerances of fittings—changes as minute as 1/10,000 in. might cause replacement.

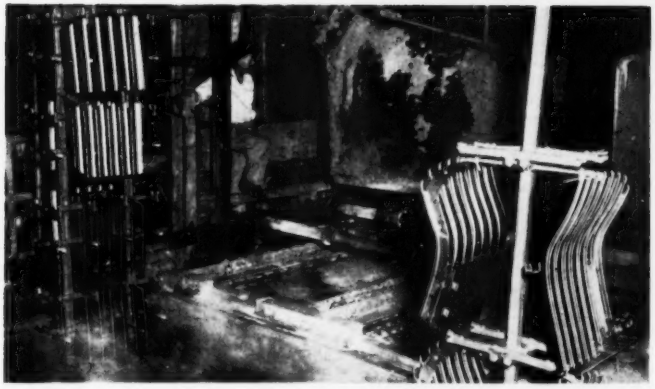
Reassembled cylinders are placed on a 1650-ft overhead chain conveyor similar to the one used for the washing process. This conveyor is used for storage purposes. Cylinders remain on the chain until time for reassembly.

Safety Crimes—Not Here!

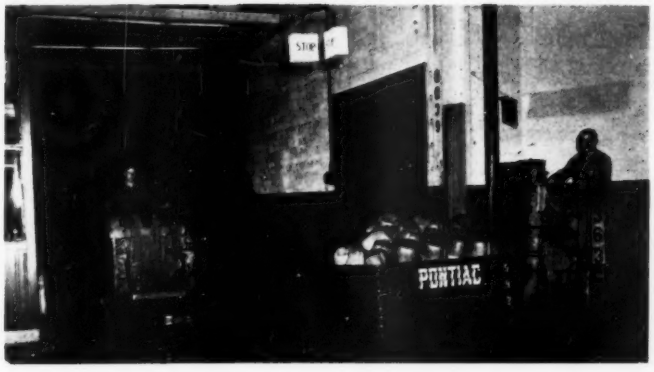
Pontiac Division, General Motors Corp., ranks high on the safety list of the various divisions of this company which has been awarded its fourth citation from the National Safety Council for its outstanding record among industrial concerns. The photos on this page show highlights of safety in the Pontiac Plant



Safety is a full-time, all-time job for the employees at Pontiac Motor Div. Many thousands of dollars and countless man-hours of effort go into making this plant a safe place to work and it ranks high in this respect. At the right is one of the three trucks recently added to the company's fire-fighting equipment. It is supplied with gas masks, CO_2 type extinguishers and special nozzles. Thoroughly trained personnel is one outstanding factor in the success of Pontiac's program of safety



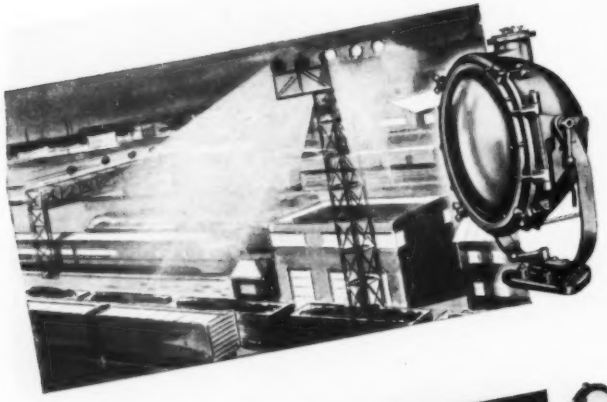
Danger points in the plant are constantly studied by four full-time employees, a director and three inspectors. They maintain contact with plant physicians so that "danger spots" in the plant can be studied and intelligent efforts applied toward accident prevention and control of occupational disease. An example of engineered prevention is shown in the elaborate exhaust system employed in the plating department to safely carry off dangerous fumes from the chrome plating system



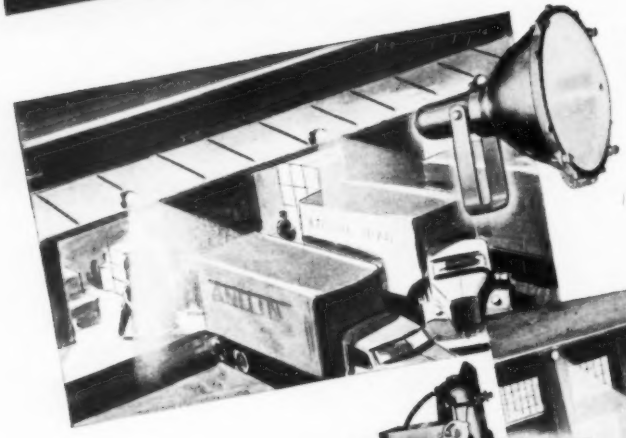
Stop-and-go signals throughout the Pontiac Division plant keep industrial truck accidents at a minimum. The signals are placed at all main intersections. All new operators, of all types of equipment, receive a thorough course of instruction in safety practices. The foremen at Pontiac realize that safe operation is as much a part of their job as are production schedules, labor relations and quality control

YOU CAN BE **SURE**.. IF IT'S

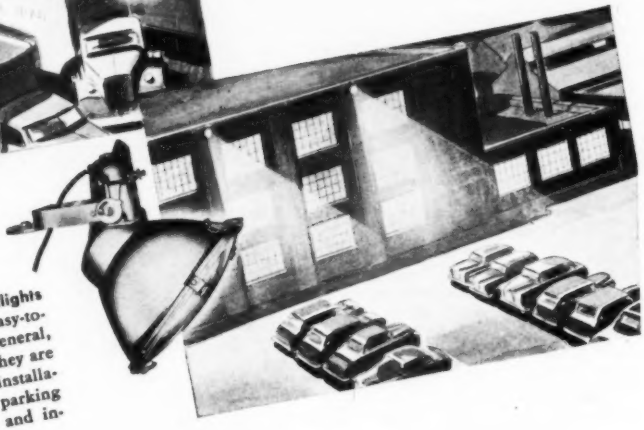
Westinghouse



Heavy-Duty Floodlight, Type CAK-20 is designed to provide maximum light output at long range required for floodlighting railroad yards, industrial and construction projects and protective plant lighting. Mounting conforms to A.R.E.E. standards for Railroad use.



General-Purpose Floodlights, Type AH-14 are economical, all-weather, hinged, covered units. Light but sturdy, they provide pin-point floodlighting for loading docks, service stations, industrial sites and industrial play areas.



Type VRC-18, Ground Area Floodlights are durable, weatherproof, easy-to-maintain units designed for general, high level, area illumination. They are suited for a wide variety of installations, such as: service stations, parking lots, sports parks, driveways and industrial areas.

MAKES A WORKING DAY

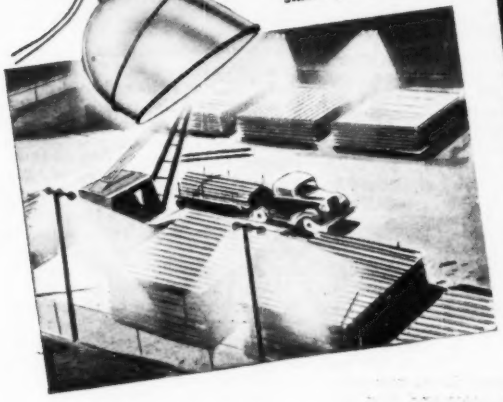
OF EVERY NIGHT

Floodlighting can make any daytime operation equally practical at night. Whatever it is, the amount of light supplied outdoors should be about the same as for comparable indoor operations. Therefore, the floodlighting units must be carefully selected to provide the desired light distribution.

Westinghouse floodlights for industrial applications are designed for the specific job . . . whether you are interested in plant protection, plant appearance or increased production.

A Westinghouse Lighting Sales Engineer will gladly co-operate with you, your local power company or electrical contractor in planning your floodlighting installation. Call your local Westinghouse Distributor today. J-04210

Ground Area Floodlights, Types AF-16 and AFA-16 are open-type, visor-protected floodlights designed to eliminate blinding glare . . . yet provide a wide beam of light. Best use is for general lighting as in lumber and coal-yards, stock areas, and small parking areas.



Type CAK-14, Heavy-Duty Floodlights are suited for jobs where rough treatment and severe weather are routine. This weatherproof unit is ideal for high-intensity, reliable floodlighting of industrial loading areas—construction projects—buildings — mines — and other rugged industrial applications.

Westinghouse

PLANNED LIGHTING PAYS

Questions and Answers

Fire Extinguisher Maintenance

Submitted by
J.Q.L., Bethlehem, Pa.

WE HAVE SOME steel fire extinguishers in our plant. They have a decalcomania label instead of the usual brass nameplate and we have been having considerable trouble with them lately. The manufacturer's name is obliterated and I wonder if you can tell me just why they are so inferior to the standard brass extinguisher?

THESE EXTINGUISHERS undoubtedly are "EAS" devices which were produced during the war because of the copper and brass shortage. The "EAS" refers to "Emergency Alternate Specifications" and you will find, through a study of these units and a comparison with standard fire extinguishers, that they are inferior due to the materials with which they were constructed.

The shells of all 2½-gal pressure units bearing the EAS approval (Underwriters' and Factory Mutual Laboratories) were made of steel instead of copper. This was true also of the 1-gal pressure vaporizing units. Steel is, of course, far more subject to corrosion than is copper.

The inner cylinder of foam extinguishers, normally of tinned copper, was made during the war of steel coated with porcelain enamel. Porcelain enamel was also used in place of brass in the construction of the pump in EAS pump tanks. Subject to cracking, porcelain enamel parts require frequent and careful inspection.

Pump packings, gaskets and similar parts ordinarily made of natural rubber were made of synthetic rubber. The hoses of all EAS extinguishers were made of reclaimed rubber. Loss of flexibility, with consequent cracking, must therefore be anticipated.

The decal nameplate which you mention, while unimportant to the proper functioning of the unit is still vital to its identification. No satisfactory method of permanent application of these decals was ever found. Loss of these nameplates, therefore, makes the use of the extinguishers hazardous. The nameplate should always be legible so that the right kind of extinguisher will always be chosen for the class of fire involved.

If it is at all possible, and it is hard to see how you can afford to do otherwise, it would be best to replace all the EAS extinguishers you now have. After all, they were intended for use only during the war period.

Can We Metallize Core Boxes?

Submitted by
Robert F. Wolff

WOULD IT be practicable to metallize an entire small aluminum core box by spraying over a wooden core print placed within a wooden frame? In this procedure, as we see it, the wooden core print would be of the exact dimensions required of the finished core and would be mounted on a flat plate. The outside frame would be for the purpose of shaping the outside dimensions of the core box. The thickness of the core box would be built up, by spraying, to about ½ in.

Would a box like this have enough strength to stand ordinary core box use without some reinforcement? You will appreciate that the desired objective with regard to an aluminum core box and a cast steel or iron permanent mold die is accuracy of the cavity without the costly job of machining.

Contributed by
John E. Wakefield

WHILE THIN shells have been made, to some extent, by spraying, this process is not used commercially for core boxes and patterns. There are, however, a great many uses for metallizing in foundry work. Aluminum can be sprayed on dry, clean wood very nicely and can be polished to the desired finish. Metal-faced patterns naturally will stand abrasion from the sand much better than will unprotected wood.

Metal spraying also is used for modifying and repairing metal patterns. For instance, an aluminum match plate pattern can be emery-paper cleaned at the desired area, flash sprayed with Sprabond, and then built up with SF aluminum to any desired thickness and then polished to shape.

John E. Wakefield, author of "Metallizing New Parts for Old," Jan. issue, Plant Engineering, repeats his offer to assist readers who have problems which might be solved by the use of metallizing. Just address your letters to Metallizing, Plant Engineering, 53 W. Jackson Blvd., Chicago 4, Ill.

Motor Rotor Locked in Position

Submitted by
F.M., Berwyn, Ill.

ONE OF THE drives in our plant requires a constant speed motor. The only machine available, however, was a 3-ph, 440-v, six-pole wound-rotor induction motor so we adapted it for use as a constant speed machine by operating it with the rotor winding short circuited at the slip ring brush holders. For starting we use a compensator with start and run positions.

In nine case out of ten this arrangement works satisfactorily and the machine will start its load and come up to speed in a normal manner. But there are times when the machine will not start and when this happens it seems as though a single phase condition exists, or that the rotor is locked in position.

At such times, by moving the position of the rotor either clockwise or counter-clockwise, with or without current on the stator, the motor will start its load without trouble. The motor appears to be in perfect condition and it has been checked for reversed poles and phases. Can you suggest what is wrong?

YOU PUT YOUR finger on the trouble when you said "it seems . . . that the rotor is locked in position." It is magnetically locked in position and the remedy is to insert external resistances in the rotor circuit during the starting period. Should this be inconvenient you might try short circuiting only two of the rings through their respective brush holders when starting. This method has generally been successful in starting a motor of this type.

Under these conditions the rotor is operating with a single phase winding and will accelerate to one-half of normal speed. It will then be necessary to short the third ring to bring the motor up to full speed.

The insertion of external resistance in the rotor circuit is, of course, the recommended method of starting wound-rotor induction motors. With wound rotor motors of small horsepower rating, however, and a load of small inertia, the method suggested above may prove satisfactory; at least it can be no more severe on the motor than the method you are now using. In the case of present-day designs the tendency to lock in position is overcome by skewing the rotor slots.

HERE'S what the chief engineer of a large sugar refinery—using its own generators and over a thousand motors from ¼ to 150 hp—has to say about "Megger"* Insulation Testers:

"Every Saturday . . . the Wizard (Chief Electrician) applied our 'Megger' Tester to all of our important generating equipment. Usually nothing happens . . . Then one day the 'Megger' test indicates a leak . . . Like the surgeon's X-ray the 'Megger' test detects the condition, and a failure is forestalled. With our insulation resistance records we further watch any progressive weakening of the 'arteries' and have warning that permits us to make repairs at convenient times . . . A maintenance gang without a 'Megger' tester would be like a surgeon without an X-ray machine."

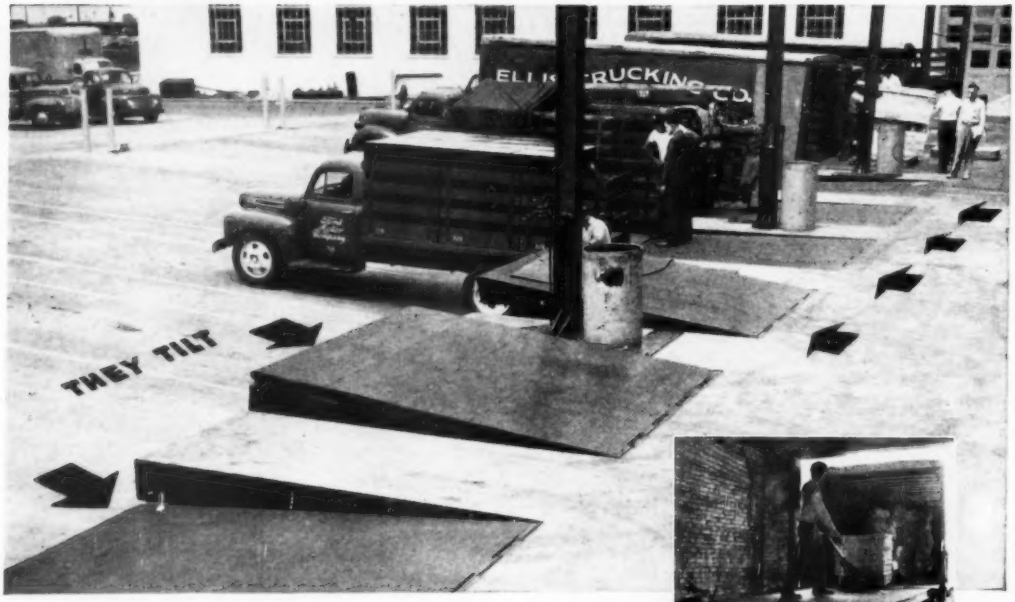
Are you getting the benefit of this kind of insurance protection for the important electrical equipment in your plant? "Megger" Insulation Testers are available in various types (including the unique "Bridge-Meg" instrument here illustrated) with ratings up to 10,000 megohms and 2500 volts d-c. Write today for illustrated Bulletin 21P7-F.

* *The photograph and the quotation in this advertisement are used by courtesy of the Pennsylvania Sugar Company of Philadelphia, and Dan Gutleben, who until recently was Chief Electrical Engineer.*

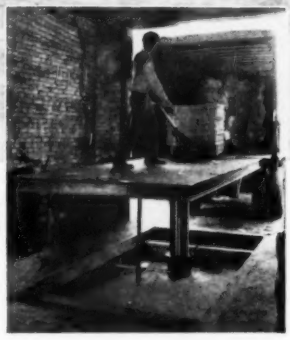
REG. U. S. PAT. OFF.

JAMES G. BIDDLE CO.
Electrical & Scientific Instruments
1316 ARCH STREET, PHILADELPHIA 7, PA.

"LOADING TIME CUT IN HALF"



Tilting Loading Dock Ramps Tilt to Meet Truck Body. Operated by Hydraulic Lifts.



Standard Wayne Platform Lift Itself Becomes Loading Dock.

Cut Costs

WITH WAYNE LOADING DOCK LIFTS

YOU CAN save time and money with Wayne Hydraulic Leveling Ramps to adjust the level of the loading dock to the truck height. Material on skids can be directly transported into the truck body over a level path. A variance of as much as 20 inches in the height of truck bodies may be instantly adjusted by merely turning a valve. Users say: "Cuts loading time in half." . . "As good as doubling dock facilities."

SEND FOR ILLUSTRATED FOLDER

Use the coupon below to get all the facts on this new plan to cut costs at the loading dock. No obligation.

THE WAYNE PUMP COMPANY, FORT WAYNE 4, INDIANA
520 Tecumseh Street

Please send folder on time-saving Wayne Loading Dock Lifts and give us some idea of the cost.

NAME _____

ADDRESS _____

CITY _____ STATE _____

for your protection

NATIONWIDE SERVICE

INDUSTRIAL AIR COMPRESSORS • HOSE REELS • BULK PUMPS • POWER WASHERS

Maintenance and Operation

Good Gasket Practice

Contributed by W.F.S., Newark

RUBBER COVERED canvas gaskets are usually satisfactory in water and steam pipe joints up to 50 psi. Between 50 lb and 160 lb rubber covered wire gaskets 1/16 in. thick are often used. Corrugated steel gaskets give good service for superheated steam where pressures exceed 160 psi. Corrugated steel gaskets are not necessary in water lines which are under either low or high pressure.

By machining the flange faces in such a manner as to support or retain the gasket, blow-out dangers are minimized, greater unit pressure is exerted upon the gasket, and possibility of leakage is lessened. The objections to these flange faces, however, such as the male and female, and tongue and groove joints, is that they cost more, are more difficult to install, and are not easily taken apart. Retained gaskets are commonly used in high pressure liquid or gas lines.

In general, the thicker the gasket the more securely it can be clamped in the joint and the less the danger of leakage. This is particularly true if the gasket is elastic.

Ring gaskets are employed in the Van Stone joint and are highly satisfactory. They are comparatively small in area, consequently a high unit pressure is exerted upon them. The disadvantage of the full-faced gasket is the lower unit pressure and the consequent possibility of leakage.

Know the Solvent or Investigate

Contributed by Safety Research Institute

WHEN A SOLVENT that is new to a plant or shop is introduced, any hazards involved should be fully understood by everyone concerned. Otherwise an accident may result, since improper handling or inadequate precautions may lead to illness or fire or both.

An accident occurred in a plant not long ago when a group of men were assigned to work in a pit under a punch press, using as a lubricant or coolant during tapping a nonflammable solvent which was new to the company. Because the solvent container was labeled with a warning to the effect that ventilation should be provided, some air was forced into the pit by means of an air hose. No one realized, however, that it was necessary to assure that this would provide sufficient ventilation in terms of the amount of solvent used and the type of place in which the men were working.

The men worked all day without complaint, all but one stopping from time to time, "to come up for air." At the end of the day, two men became ill and one of them, the man who had worked with no interruption throughout the day, died a few days later.

In another plant, employees were given a new paint for use on machinery but were unaware that the solvent in the paint was highly flammable, although the label warned that the material should be kept away from flames. The men applied the paint while a welding operation was going on nearby, and a serious explosion followed.

If the label on an unfamiliar solvent carries warning statements which are not fully understood, detailed information on properties and necessary precautions to be observed should be obtained from the manufacturer before the product is put to use. In many states and cities, such information is also available from the industrial hygiene division of the health or labor department.

Cold Weather Protection For Concrete

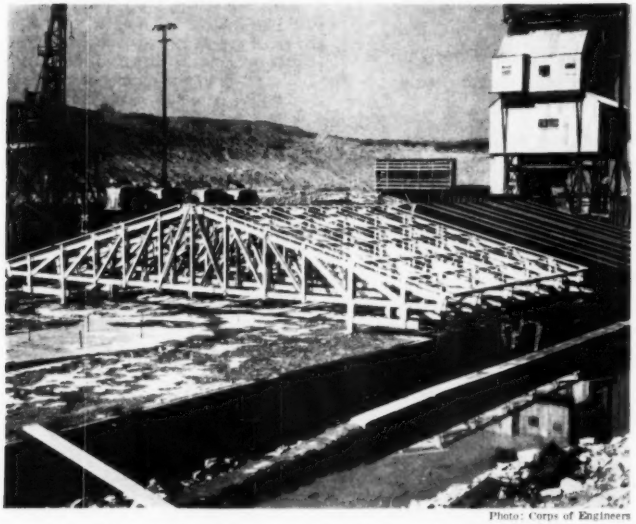


Photo: Corps of Engineers

Tarpaulin and tarpaulin frames were erected over this piece of construction on Locks 27 located in the Mississippi River below the mouth of the Missouri River in the St. Louis district. Known as the Chain of Rocks Project, these locks are designed to correct a river condition that has constantly interfered, in varying degrees, with river traffic

Insulation Inspection

Contributed by Magnesia Insul. Mfrs. Assn.

TO PROVIDE maximum insulating value, all heat insulation requires a regular inspection and maintenance program. The steps in such a maintenance program are outlined below:

1. Periodic inspection to see that all sources of heat loss, such as new sections of piping, etc., are insulated.
2. Periodic evaluation of insulation thickness, since changes in operations of fuel costs may necessitate an increase in thickness.
3. Survey of insulation jacketing to check for adequate protection against weather, mechanical or chemical damage, etc. Scorched spots are thoroughly investigated, since they may indicate a crack or failure in the insulation underneath, or may be a sign that the insulation is too thin.
4. Check of the insulation for loosening. If due to excessive vibration of the insulated equipment, the cause of vibration is eliminated, if possible, and the insulation is reapplied and tightened. Joints are

You'll get better filtering at lower cost . . .

with NUGENT NUPACK
Graduated Density
Oil Filter Recharges

Genuine Nugent Nupack replacement cartridges assure you of the dependable, trouble-free service which your Nugent filters were built to give. Comparative tests of genuine Nugent recharges and imitations have proved that Nugent recharges last up to twice as long and absorb up to eight times the carbon, grit, etc., providing cleaner, safer fuel or lube oil all the time.

Nugent Nupack Recharges are cellulose filter elements, graduated in density so that dirty oil passes through progressively finer fibre structures until at the center of the recharge, dirt and carbon particles as small as a few microns are removed. Uniform dirt loading means maximum life and maximum efficiency from the unit.

Nugent Nupack Recharges are sized to fit existing Nugent filter shells. For complete information and prices send us the figure number and sizes of your Nugent Filters.

NUGENT TRADE MARK

Wm. W. Nugent & Co., Inc.
430 N. Hermitage Ave. CHICAGO 22, ILLINOIS

OIL FILTERS, OILING AND FILTERING SYSTEMS, TELESCOPIC OILERS, OILING DEVICES, SIGHT FEED VALVES, FLOW INDICATORS

Established 1897

Representatives in Boston • Cincinnati • Detroit • Houston • La Junta, Colo. • Los Angeles Minneapolis • New Orleans • New York • Philadelphia • Portland, Ore. • San Francisco Seattle • St. Louis • Tulsa • Representatives in Canada: Montreal • Toronto • Vancouver

pointed up with cement and the canvas or other jacketing replaced and securely sealed. If the vibration cannot be eliminated or reduced, another method of application of insulation may be necessary.

5. Examination for dents or cracks. Dents may be caused by mechanical abuse of insulation, such as erection of scaffolding, etc. The damaged section is cut out and a new one of the same size and shape is wired on securely. The cracks are filled with insulating cement and the protective jacketing is replaced.

6. Check after repairs of equipment due to difficulties such as water hammer, leaks, etc., which may have caused damage to the insulation.

7. Survey of insulation after disasters such as fires, floods, etc. Lines or equipment on which insulation has been saturated by water should be brought up to full temperature slowly to prevent too rapid formation of steam between the hot surface and the insulation.

Cutting Oil Test Results

OWING TO THE large quantity of piping used in our modern plants, the kind of cutting oil employed in cutting pipe threads is most important. You will often find that it pays to make comparative tests, using various kinds of cutting oil and then figuring and comparing costs after the tests have been run.

For example here are the results of some actual tests. No. 1 oil cost 29c per gallon from the manufacturer and 4c per gallon when mixed; oil No. 2 cost 82c per gallon from the manufacturer and 6¾c per gallon when mixed.

The figures below give the number of pipes threaded while using a full drum of each of these cutting oils, also the percentage of good pipe and the percentage of bad threads. It is interesting to note the number of die changes in the two oils.

Cutting Oil No. 1

	Pipe Ends	*Per Cent*
Pipe threaded	205,352	....
Good pipe	181,762	87.30
Bad threads	23,590	12.97
Die changes, 816		
Cut per die	250	....
Good pipe per die	222	....

Cutting Oil No. 2

	Pipe Ends	*Per Cent*
Pipe threaded	266,558	....
Good pipe	256,084	96.07
Bad threads	10,474	3.93
Die changes, 375		
Cut per die	710	....
Good pipe per die	682	....

These particular tests indicate that the first cost of a cutting oil is not of great importance where considerable pipe threading is done. Use a quality oil and the ultimate cost will be considerably lower.

30-YEAR OLD MONEL PUMP RODS OUTLAST OTHERS 9 TO 1

Fairbanks-Morse sump pump. The 30-year old MONEL pump rods have never been replaced or reground, show very little wear, and seldom need repacking.

In the basement power plant of a large building in New York City, two pumps work side-by-side.

Both pumps handle a sump mixture of gritty ash-quenching waters, polluted waters from ground seepage, corrosive waters from coal drainage.

Identical service...but their maintenance stories are far from identical!

In 1918, MONEL* rods were installed in the first pump, a Fairbanks-Morse. These *rods are still giving perfect service today, thirty years later.*

The second pump (not a Fairbanks-Morse) originally had bronze rods. In the first ten years of service, these rods were replaced *three times.* In 1935, MONEL rods were installed. They have been giving perfect service ever since...*for thirteen years.*

The chief engineer says of the MONEL rods: "In my opinion, they will last as long as the pumps."

This is a story worth remembering next time you need pump rods, new or replacement. For when you specify MONEL, you get a "task metal"...one that is rustproof, corrosion-resistant, stronger than structural steel, hard, tough, yet readily machinable.

If your problem involves corrosion or excessive wear of working parts, why not write to Bob Johnson of INCO? He may be able to help you find a solution.

*Reg. U.S. Pat. Off.

MONEL

...FOR MINIMUM MAINTENANCE

EMBLEM OF SERVICE

INCO

THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street, New York 5, N. Y.

New Products and Methods

(Continued from page 24)

tion. If signals go out of service or bulbs burn out, the operator knows at once.

Where there is an abnormal condition, two signal lights go on and a warning is given by a horn, or other sound device. When the failure is acknowledged by the operator the horn is turned off, and the white light goes off. The horn is immediately back in service for monitoring any further failure. Thus a single horn serves for any number of alarms.

Many combinations of lights and signals are available to indicate the trouble line, also to indicate when corrective measures have been taken, and finally when the line is cleared back to normal.

Flexibility in use and design is insured by allowing extra spaces in the cabinet for spare units. The price of all cabinets is practically the same so that extra spaces can be provided for at a minimum cost.

Panalarm cabinets are adapted to flush mounting on central control panels or to wall mounting in any desired location. Systems are completely wired and only simple wiring connections to terminal blocks are required in the field. Bulletin 300 Series explains them in detail. Cost per unit between $30.00 and $40.00 depending on type and quantity. Panalarm Products, Inc.

43—TEMPERATURE CONTROL

For cooling water systems; is compact and economical

Here's a new self-operated, rigid stem type temperature regulator for limiting flow of cooling water through engine and compressor jackets, hydraulic presses, vapor degreasers and condensers to maintain constant temperature. Operates by difference in compression strength of two springs, 2 and 9, and thermal expansion and contraction within a tube of oil, 8, containing a collapsible tube or bellows, 6.

When heat is applied to thermostat, expansion of oil and compression of bellows lengthens the thermostatic member. As it does not compress relief spring, 2, it forces downward the thermostat casing, 8, to which valve stem is attached, thus opening the valve. When thermostat cools, operation is reversed and valve closes. General operation resembles mechanical movement of a pogo stick. In sizes $\frac{3}{8}$ to $1\frac{1}{2}$ in. for water pressures up to 150 psi. Sarco Co., Inc.

Do you want more information on this equipment and its application. Use the no obligation, no postage card between 18-19 and 58-59

BETTER WASH FACILITIES... for Women Workers

Because of the increasingly large number of women employed today, it is important that there be adequate washroom facilities for women as well as for men. For newly designed buildings and for modernizing present buildings, therefore, Bradley Washfountains are invariably specified.

Bradleys provide convenient, sanitary service for 8 to 10 persons at one time. The central sprayhead replaces faucets. Bradleys also save on water and heating costs, require only minimum maintenance, and are easy-to-install. For maximum utility per dollar invested, specify Bradleys. You will find suggestions on washroom planning in illustrated Catalog 4701. Copy mailed on request. Write to BRADLEY WASHFOUNTAIN CO., 2371 W. Michigan St., Milwaukee 1, Wisconsin.

BRADLEY washfountains

You will find suggestions on washroom planning in illustrated Catalog 4701. Copy on request.

Distributed Through Plumbing Wholesalers

44—MOTORIZED DRUM TRUCK

Mixes liquids and powders in cylindrical cans and drums

Low cost, safe, mixing and agitating of compounds in round containers from 1 to 55 gal. capacity is claimed possible with this new portable motorized drum cradle truck, the Rotator.

A $\frac{1}{2}$ hp enclosed motor under truck frame furnishes power for rotating a full drum load up to 500 lb at speeds of 10, 20 and 40 mph. It's said that a man can safely load and unload a 500 lb drum by means of tipipng lever.

Sturdy truck frame is electrically welded. Swivel casters at front, retracted by foot lever at rear to prevent slippage in loading facilitate steering. Quick drainage of drum contents can be made underneath or at rear of truck. Special idler rollers rotate any size container. A safety catch on angle nosepiece holds drum steady while truck is being rolled. Morse Mfg. Co.

45—LIGHTWEIGHT HOIST

Is strongly constructed for heavy-duty work

Outstanding feature of the Auto-Bloc hoist is simplified hoisting mechanism, which employs only 2 gears and affords weight savings. These are a cam-actuated floating inner gear and an outer gear to which the load sheave is connected. Gears of special alloy steel, provide maximum strength with a larger number of teeth in mesh. The Auto-Bloc cover claimed unbreakable, is drop-forged from chrome manganese steel with a tensile strength of 200,000 psi. Every working part is high quality heat-treated steel. No lightweight materials are employed. Available in 16 standard models of $\frac{1}{2}$ to 40 t capacity, every hoist is factory tested for 50 per cent overload. David Round & Son.

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The only unusually rugged plug-in or trolley busway in 2, 3 or 4 pole construction in one compact housing.

Pre-fabricated LTG FLEX-A-POWER — rated 50 amps — 250 v, AC or DC — supplies power for fluorescent lights and power tools. It provides both trolley power take-off and a continuous outlet — you can tap at any point . . . ideal for industrial plants, offices, stores, arenas, work shops and garages. Here are more new features:

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3. **PERMITS BALANCED LOADS** — plugs or trolleys are polarized which provides a convenient means of balancing loads.
4. **IT'S REALLY RUGGED** — rigid construction of housing itself prevents sagging — only 2 hangers needed for each 10 ft. section.
5. **MORE FLEXIBILITY** — standard fittings such as elbows and radius sections permit economical custom installations — easy to disassemble and relocate.
6. **GREATER CONVENIENCE** — trolley with silver alloy contacts may be inserted or removed at any point along the run — no "drop-out" section required.

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Bulletins . . . . Catalogs

BUILDINGS, GROUNDS

101 Roofing Catalog—"Galbestos," an industrial roofing and siding material that's easily erected and adaptable to all types of structures, is the subject of this 24-pp illustrated booklet. It illustrates and describes the material, showing coatings and corrugations available, and discusses their particular applications. Stresses strength and light weight of this roofing, its fire and corrosion resistance and other advantages. Includes technical data for standard construction. H. H. Robertson Co.

102 Roofing Insulation Bulletin—The advantages of a felt-sided roof insulation are described and illustrated in 4-pp Bulletin BU-62A. It tells about this material's low heat conductivity, moisture and rot resistance and snug fit, and why it's economical to use. Pictures show the insulation material in detail and being applied to a roof. One page is devoted to manufacturer's roofing material recommended for use with this insulation. Johns-Manville.

103 Building Unit Bulletin — This 4-pp folder covers a line of structural, insulating, fireproof and sound absorbing modular building units made of pre-cast concrete slab. It explains their advantages, versatility and economy. Illustrates and describes applications of the five different forms — multi-purpose slabs, roof slabs, lightweight hollow blocks, joist soffit blocks and acoustical tile. Technical data includes sound absorption coefficients, physical properties of material, and standard sizes and weights of available forms. Durisol, Inc.

104 Ceiling Construction Manual—Recent developments in installing ceiling materials with or without acoustical materials have been added to the 1949 edition of Catalog N-1, 12 pp. This book also covers basic principles of manufacturer's method of ceiling construction, equipment involved, ease and speed of installation and advantages, safety factors and permanence. Includes specifications, diagrams of installations and many photos showing ceiling materials being installed by this method. Also lists related products and distributors. Nailock Steel Div., The Sanymetal Products Co., Inc.

105 Industrial Flooring—This four-page, full-color bulletin is devoted to a plastic resin flooring for industrial use and includes a color chart showing available shades and marbleized patterns. Tells briefly how this flooring resist wear, fire, moisture, grease and oils, and how easily it can be installed, maintained and altered. Includes specification data and several photos of installations. Hercules Flooring Co.

106 Floor Care Booklet—The problem of safety and polished floors is presented in a new 8-pp booklet called, "Mr. Higby Learned About Floor Safety the Hard Way." It's written as the story of an executive who fell on the slippery floor in his own office, and decided to find out why. It follows his investigation as he learns why his floors needed waxing so often and were slippery. It suggests methods by which floors can be polished and still be safe and how housekeeping costs can be cut. Walter G. Legge Co., Inc.

107 Syrup-Resistant Flooring Data Booklet—Resistant to most syrups, acids, fats, alkalis, oils, is this new "Resn-X" floor coating. The data booklet gives complete properties of the covering, tells by means of extensive tabular material just what it protects against and the degree of excellence attained by this protection, gives complete application instructions. The booklet points out that the floor coating may be troweled over concrete, wood, brick, quarry tile or steel and tells what special precautions are necessary. A list of suggestions is appended. Rock-Tred Corp.

108 Cold Storage Doors—Bulletin No. 175, 12-pp, a condensed general catalog, contains valuable help for plant engineers in selection of proper type doors for refrigerating departments. Three main sections of catalog cover doors for moderately low temperatures, zero and sub-zero use, and special cold storage uses. Photos and diagrams show details of construction and specification tables are provided for all standard models. Jamison Cold Storage Door Co.

109 Fence Catalog—Plant engineers interested in fencing industrial areas will want to consult 40-pp Catalog No. 110. It's filled with pictures of fences in use throughout the country and each photograph is accompanied by a brief description as to its type and suitability for that particular application. By means of these pictures authors also point out various types of wire mesh and framework, posts, use of barbed wire, guards and gates. In addition there are sketches showing exclusive construction features of manufacturer's line of fencing, details of bracing, fastening, post foundation, post tops, gate corners, etc. Specification tables are included. Anchor Post Fence Div., Anchor Post Products, Inc.

110 Wire Cloth and Screens—Described as a "handbook of useful information," this 48-pp catalog offers plant engineers valuable help in selecting and ordering industrial wire cloth and woven wire screens.

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It's generously illustrated with photos illustrating wire sizes, spacing, weaves and crimps and types of openings. It discusses applications of these different types, and metals used. Technical data includes weights of copper, brass and wrought iron wire per 1,000 ft, a table showing difference between wire gages, and an inch-millimeter conversion table. Most listings include prices. Korb-Pettit Wire Fabrics and Iron Works, Inc.

MATERIALS HANDLING

111 Straddle Truck Catalog—Sixteen-pp Form 1118 introduces a revised model "M" straddle truck of 18,000-lb capacity and discusses its improvements in design and engineering. Stresses economy afforded by this larger capacity truck and includes complete specifications, dimensions, load capacities and weights. Includes many photographs of this truck in typical industrial service and there's a large photo of the truck illustrating construction and design features which contribute toward easy and efficient operation, greater visibility and safety. Hyster Co.

112 Ilc-a-day Motorized Hand Truck—The company's 1949 model "Transporter" is well described in this recently-issued Bulletin 1010. A complete explanation of the ease of the unit's operation is presented and reasons for its economical operation are covered. For instance, the bulletin calls attention to the fact that the Transporter operates with a standard 11-plate battery and that the battery can be recharged from a light socket. Complete specifications, dimensional and constructional, are given along with photographs which tell of the Transporter's adaptability. Automatic Transportation Co.

113 Lift Truck and Tractor Guide—This 28-pp pocket-size condensed catalog contains operational data and information on manufacturer's line of fork lift trucks, tractors and accessories. Each truck listing includes specifications and a photograph of the model in use. Accessories are illustrated with sketches showing principles of operation. Several pages are devoted to pictures of trucks and tractors at work. Towmotor Corp.

114 Freight Elevators—Bulletin B-705 (8410), 8-pp, is devoted to freight elevators specially designed for industrial power truck loading. It describes and illustrates, by sketches, how these elevators are built to withstand impact, off-balance and extra static loading. Construction features are illustrated and discussed in detail and there are cross section drawings of installations. Dimensions of most commonly specified sizes and capacities of these elevators are given in tabular form. Otis Elevator Co.

115 Dock Loading Equipment Bulletin—Hydraulic loading dock ramps and truck lifts that "tilt to meet the load" are described and illustrated in Form 818-R, 4 pp. Stresses savings in loading time and cost made possible with these ramps and lifts. Photographs show several installations. Specifications for both dock ramp and truck lift are given. The Wayne Pump Co.

116 Overhead Handling System Manual—Bulletin No. M3 is a complete technical manual on an overhead conveyor system adaptable to almost any industrial handling situation. Illustrates and describes in detail chains, trolleys, wheels, straight track and curves, expansion joints, drive units, shears, take-ups, roller turns, traction wheels, carriers, bridges and housing. Contains complete specifications, dimensional drawings and data, and ratings. Several pages are devoted to photos of specific installations and show this conveyor system in use in a textile mill and manufacturing plant. Has 98 pp, firm covers and ring binding. Mechanical Handling Systems, Inc.

117 Crane Catalog—This 24-pp illustrated book covers manufacturer's line of overhead cranes, individually designed for each

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Bulletins . . . . Catalogs

installation but constructed of standardized detail parts. It describes and illustrates bridge girders, trolley details and trolleys, bridge details; also magnetically controlled cranes. Many photographs show typical crane installations both inside industrial plants and outdoors. Floor controlled and special cranes are also illustrated as are cranes with auxiliary hoists. The Euclid Crane & Hoist Co.

118 Tractor Shovel—Eight-pp Form No. 183 tells about a large tractor shovel with 4-wheel drive and 1½-yd bucket. Describes and illustrates by photos and sketches how this large "Payloader" is easily operated for digging, loading, dumping, bulldozing and carrying. Gives specifications, explains construction features and includes many photos of model at work. The Frank G. Hough Co.

119 Diesel Switch Engine—"Switching Power That Saves" is the title of 24-pp pocket size Bulletin GEA 5183. By means of short, individually illustrated paragraphs, this little book presents facts to show how a plant-owned Diesel engine can cut costs while doing a good job with the switching. Tells how it reduces cost of fuel, crew labor, water and maintenance of both engine and track. As a clincher it shows how one plant saved $11,000 a year on a $31,000 investment. Explains engine's efficiency in terms of full horsepower at low speeds, easy operation, increased safety and improved community relations. Illustrations include photographs and sketches. Apparatus Dept., General Electric Co.

120 Lowering Unit—Illustrated Bulletin D-M518, 4 pp, describes a portable automatic lowering unit designed to reduce hand lifting and stooping. It tells how these units—which can be pushed around like an ordinary hand truck—are spring operated and calibrated to keep bank of materials always within hand level, lowering as weight is added, raising as it is removed. Stresses advantages of use, including lessening of fatigue and saving of storage space. Lowerator Div., American Machine & Foundry Co.

121 Wire Rope Slings—Details of design, advantages and applications of flat laced wire rope slings are furnished in 12-pp Bulletin No. FLS-49. It's illustrated with photos showing these slings handling heavy machinery, a Diesel truck, refinery tower, transformer, etc. Photos also show different types of hooks and loops. Drawings illustrate detail of rope sections and lacing. Technical data includes dimensions and weights, safe loads of slings and fittings, and dimensional drawings. A. Leschen & Sons Rope Co.

122 Magnetic Pulley Data—Bulletin 350, 8 pp, describes permanent magnetic pulleys of Alnico magnet steel. Discusses economy and performance of these magnets; tells how to select them. Gives specifications and dimensions of pulleys and pulley separators and includes graph showing comparative strength of these and other magnets. Photos show some typical installations. Stearns Magnetic Mfg. Co.

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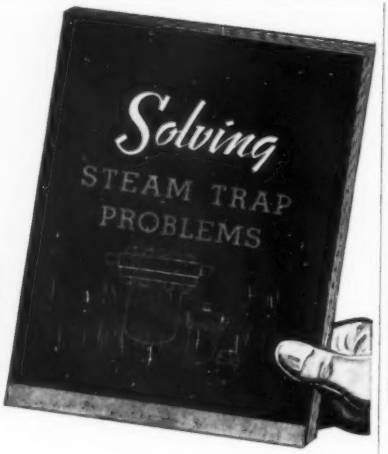

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123 Electrical Wires and Cables—Here's a 24-pp general catalog covering practically all types of electrical wire and cables and arranged for easy reference. Wires and cables are illustrated to show construction details and listed with sizes, weights, specifications and necessary ordering information as well as discussion of applications. It's a handy ordering guide for anything from trolley wire for overhead cranes to flexible cord for light fixtures. John A. Roebling's Sons Co.

124 Fluorescent Lamp Ballasts—Bulletin GET 922B, 20 pp, gives complete information on installation, operation and testing of ballasts for fluorescent lamps. Contains sections on lamps and starter switches in addition to those covering inductive and inductive-capacitive ballasts and inductive starting ballasts for d-c lamp operation. Includes photos of ballasts, tables of ratings and test data on manufacturer's lines, wiring diagrams and procedures for testing ballasts. Specialty Transformer and Ballast Div., General Electric Co.

125 Lighting Equipment Catalog—Information necessary for selecting and ordering fluorescent and incandescent lighting equipment is presented in easily-read digest form in pocket-size Catalog No. 46A, 32 pp. It's illustrated with photos and sketches of equipment and construction features, including "Jackknife" hinge which lowers vital parts for easy cleaning and servicing. Includes sizes, specifications and mounting data. An 8-pp folder which accompanies this catalog gives prices on all equipment. The Edwin F. Guth Co.

126 Distribution Lightning Arresters—Bulletin GEA 2977B, 12 pp, describes and illustrates lightning arresters for protection of distribution secondary line equipment, watthour meters and other power devices and appliances on secondary services. Discusses major considerations in protection of low voltage a-c power circuits and secondary services, and describes pellet arresters, thyrite protectors and pellet protectors in detail. Includes photos of equipment, dimensional data, ratings, oscillograms showing impulse protective characteristics. Also quotes prices. Apparatus Dept., General Electric Co.

127 Substation Transformers—Illustrated Bulletin 61B6014A covers industrial substation transformers. Describes operational and constructional features which contribute to efficiency and service life of these transformers. Photos show typical complete larger and smaller models and construction details. Also included are dimensions and ratings. Allis-Chalmers Mfg. Co.

128 Annunciator Bulletin—Eight-pp Bulletin 120 describes and illustrates supervisory annunciators designed to give visible and audible alarms whenever overheating, low fuel oil or cooling water level or other conditions call for prompt attention. Shows photographs of several models, including lamp type, manual reset type, illuminated stencil type, and special designs and discusses each in detail. Tells type of signals provided, performance, resetting, mounting, construction, wiring, equipment furnished and further equipment required for use. Discusses briefly the role of annunciators in preventing shutdowns of vital services and protecting costly equipment. Auth Electric Co., Inc.

129 Safety Device—Bulletin No. 51, 4 pp, describes the "Microtrip," one of the line of microswitches which when installed makes necessary two-hand operation for actuating power driven equipment. Explains how this device works and how it keeps operator's hands away from hazardous areas while machine is running, and stresses its value in increasing production by decreasing fatigue. Photos show men and women working at punch presses, riveting machines and spot welding machines equipped with this device. Micro-Switch Div., First Industrial Corp.

HEATERS, HEATING

130 Infrared Processing—The advantages of an infrared system for baking, drying, pretreating and dehydrating are described in this recent 6-pp illustrated bulletin. Tells about manufacturer's infrared system, its lamps, ovens, air control, utilization of energy, construction features and low operating costs. Stresses savings in money, man-hours, equipment and floor space said to be possible with this system, and improvement of product involved. Contains several pictures of infrared systems in use in various industries. The Fostoria Pressed Steel Corp.

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131 Stoker Bulletin—Technical information on manufacturer's line of hydraulic ram-type stokers is contained in this 8-pp illustrated bulletin. Emphasizes the design features which contribute to length and efficiency of service and includes ratings and specifications. Photos of stokers and oil pump fan and assembly are included. Cut-away drawing shows construction and operation. The Frederick Iron and Steel Co.

132 Unit Heater Bulletin—The manufacturer's line of standard propeller fan unit heaters is covered in Publication WN-126, 12 pp. It explains quiet operation of these heaters and describes their heating elements and casing design. Tables show basic ratings of heaters with standard and low temperature heating elements, dimensions, Btu correction factors, and forced hot water heating capacities. Application data includes discussion of air volumes and final temperatures, location and mounting length, length of blow, entering air temperature, and temperature control. Warren Webster & Co.

133 Tubular Heaters—This 24-pp illustrated booklet describes a line of tubular heaters originally designed for heating oil and corrosive fluids in gasoline plants and refineries, but which have also been successfully used for high temperature heating and other applications including those involving severe field operation conditions. Discusses two types of heaters—those with cast return bends and those with welded forged return bends—their construction and applications, and gives specifications. Black, Sivalls & Bryson, Inc.

134 Heating Element Data—Bulletin No. 20, 8 pp, contains detailed capacity and dimension tables on manufacturer's "Para-

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coil" heating elements. Illustrations and descriptions provide instruction for installation of heating elements and diagrams show six commonly used installation arrangements of hot water generation using these heating elements and storage tanks. Includes conversion table for steam and temperature conditions for determining capacity of any size heating element. Davis Engineering Corp.

135 Surface Radiation—Bulletin B 1550C is a 9-pp data book on extended surface radiation for steam or hot water heating. Gives construction details of tubing, fins, brackets, offset adapter, covers and expansion connectors. Discusses best locations for radiation and includes two pages of photographs and sketches of typical installations. Also includes dimensional diagrams and ratings. Punched for filing in binder. Warren Webster & Co.

136 Roughing-In Radiator Data—Here's a 16-pp pocket manual, Form No. 539, providing dimensions, capacities and other data for both current and obsolete types of manufacturer's line of radiators. Plant engineers will find it useful in selecting radiation for new installations and in determining amount of radiation on existing installations. (This permits accurate selection of correct capacity boiler.) Also included are engineering drawings of radiator sections, rating tables, and information about pedestals, hangers and brackets. The National Radiator Co.

137 Lining Bulletin—A simple means of lining flues, ducts and breechings is described in this 4-pp bulletin. Tells how method can be adapted by user to any duct lining problem. Describes and illustrates insulation, studs and casting and shows how they are applied. One page tells how to estimate necessary material for job and how to order it. M. H. Detrick Co.

PROTECTION, TREATMENTS

138 Drip Preventive Handbook—The insulation of pipelines, tanks, cold air conditioning ducts, and wall surfaces against corrosion and condensation drip is covered in this pocket-size, 32-pp handbook, Form F-17. Describes an insulation coating and its applications and tells how to prepare surfaces for it and apply it. Photos illustrate these instructions and show coating in use. Technical data includes tables showing pipe and tank surface coverage and humidity charts. Letters from industrial users of this coating are quoted and prices listed. J. W. Mortell Co.

139 Cathodic Protection Equipment—Oil immersed metallic rectifiers for cathodic protection of underground structures against corrosion due to galvanic action and electrolysis are covered in Bulletin B3996, 8 pp. Discusses principles of cathodic protection and explains how rectifiers operate to provide it. Illustrates available models for outdoor and indoor use and describes both copper oxide rectifiers and selenium rectifier stacks. Includes specifications and standard ratings. Westinghouse Electric Corp.

140 Corrosion Analysis—Excellent working data on galvanic corrosion is contained in this 8-pp technical study of corrosion by concentration cells, reprinted from Inco Corrosion Reporter, Vol. 3, No. 1. Discusses concentration cells, the metal-ion cell type, oxygen cell type, reversible concentration cells, their practical aspects and some rules for minimizing or preventing concentration cell corrosion. Illustrated with sketches showing conditions which accelerate corrosion. The International Nickel Co., Inc.

141 Protective Coating—Bulletin 1540, 4 pp, is devoted to a corrosion resistant coating for cold, wet surfaces. Tells its protection against corrosive effects of natural fresh and salt water, cold acid and alkali solutions, acid fumes and atmosphere under shelter. Discusses in detail the use of this coating in water storage tanks and in condensers. Tells how coating should be applied and how to order it. Bulletin also includes photos and description of equipment recommended for use in applying the coating. The Dampney Co. of America.

142 Rust Remedy—Here's a 6-pp folder describing a remedy for rusting metal which can be sprayed or painted right over the rust. Explains how coating penetrates rust layer and seals surface against further rusting. Discusses its resistance against moisture, temperature changes and chemical fumes. Gives step-by-step directions on how to apply it and lists some industrial uses. Speco, Inc.

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FANS, PUMPS, AIR CLEANING

143 Dust Collector Equipment—Bulletin No. D-491 was compiled to help plant engineers "visualize dust control equipment." It's an 8-pp collection of photographs of actual installations, showing dust filters at work in cement packing houses, a boiler shop, a feed mill and other industries. The W. W. Sly Mfg. Co.

144 Pump Data Sheet—Technical information on single suction, multi-stage pumps is provided in 8-pp Bulletin 103. Cut-away photographs of models illustrate discussion of construction features, and a typical sectional elevation accompanies parts list. Also included is a performance graph of a 4-stage pump and photographs of several pumps. Frederick Iron & Steel Co.

145 Precipitator Bulletin—Six-pp Bulletin DL-P-1513 stresses the over-all economy of an electronic air cleaner in eliminating smoke, dust, smudge, bacteria and pollen. Illustrates and describes precipitator models with and without blower. Gives dimensions and specifications, and illustrates operating principles. Photos show typical installations. Raytheon Manufacturing Co.

146 Pump and Heater Sets—This 4-pp illustrated bulletin is devoted to fuel oil pump and heater sets designed to meet specific requirements. Contains schematic drawing showing basic unit and several photographs of complete installations. Describes both "simplex" sets having a single group of component elements and "duplex" sets in which all equipment is in duplicate, so each item could carry the entire load, to eliminate possibility of a shutdown. Peabody Engineering Corp.

147 Fan Catalog—Industrial ventilating and cooling fans and their applications are covered in 6-pp Catalog No. 864. Describes and illustrates, by photographs, available fan types and gives their specifications and shipping weights. Includes additional data on selecting proper fans for particular jobs and stresses economy of fans in maintaining plant efficiency particularly during hot weather. Also describes and illustrates automatic louvers. 1949 prices are quoted on separate 4-pp folder. Chelsea Fan & Blower Co., Inc.

MECHANICAL POWER TRANSMISSION

148 Leather Belting Manual—"How to Select, Install, Maintain Modern Leather Belting" is the title of this well organized and clearly written 28-pp guide to maximum belt performance. It explains how leather belting can save money and space and increase production; tells how to select and order it for various drives and applications and includes handy formulas for finding belt speed, length, arc of contact, etc. A chapter on installation discusses aligning, tension, running direction, quarter turns; it illustrates tools needed for the work and includes step-by-step directions for handling single- and double-ply belting. Chapter on maintenance tells how to care for belts, clean and dress them and shorten them. American Leather Belting Association.

149 Adjustable Speed Drive—Bulletin 311, 8 pp, on all-electric adjustable speed drives for a-c circuits, tells how these packaged drives contribute toward increased production and decreased costs; and how various functions can be directed manually or automatically with centralized control at machine or at remote location. Includes many photos showing drives being used in different industries, also photos of motor and control unit and schematic drawing of rotating system and table of ratings. Reliance Electric & Engineering Co.

150 Push Pull Control—Titled, "The Key to Remote Control," Bulletin DH-87, 4 pp, contains technical information on manufacturer's line of push-pull controls and should be of interest to plant engineers

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☐ No. 4013-A Single Stage, Side Suction, Two Ball Bearing Centrifugal Pumps. Sizes 1" to 6" discharge. Capacities: 10 to 1200 gallons per minute.

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DEMING
THE COMPLETE LINE
PUMPS AND WATER SYSTEMS

confronted with problem of transmitting back-and-forth action to a desired point. Discusses standard assembly of these controls, anchorage and capacities. Includes drawings showing dimensions and assembly of units, tables showing backlash, minimum recommended radius and maximum recommended input load in pounds for travel in inches, and graph showing friction loss. Automotive and Aircraft Div., American Chain & Cable Co., Inc.

TOOLS

151 Tool Catalog—Form No. 10, 20 pp, is the 1949 edition of manufacturer's standard catalog on portable electric tools and covers practically all such power operated tools and related equipment. Most items are illustrated with photo of model and listings include specifications, sizes and prices. It's arranged for easy reference, easy selection and ordering. The Black & Decker Mfg. Co.

152 Hydraulic Equipment Catalog—Designated as Preliminary Postwar Catalog No. P-46, 24 pp, it lists manufacturer's complete line of lightweight "Porto-Power" hydraulic equipment, including new and reinstated items, for creating and applying hydraulic force for pushing, pulling, pressing, bending, spreading and clamping jobs. Describes advantages and applications; lists units, assortments and attachments. Illustrations include photos and sketches of equipment, including many pictures of it in use. Blackhawk Mfg. Co.

MAINTENANCE

153 Metal Maintenance—Bulletin C-2 4 pp, titled, "How to Protect and Repair Metal Equipment for Corrosive Service," tells plant engineers how to mend cracked, broken or corroded metal surfaces of practically all process equipment and how to protect metal against corrosion damage. Explains necessary treatment for specific conditions, tells coating best suited for the job and shows how to prepare surface, mix coating and apply it. Lists acids, alkalis, solvents and salts to which manufacturer's thermosetting resin coatings are resistant and discusses each of these coatings in detail. Carboline Co.

154 Steel Drum Maintenance—Bulletin 574, titled, "Cleaning Problems Solved in the Reconditioning of Steel Drums," is an 8-pp booklet describing airless abrasive blast cleaning equipment. Covers importance and economy of thorough drum cleaning for good adhesion of paint or organic coatings and explains operation of manufacturer's equipment. Discusses in detail several installations. Line drawings illustrate each type of machine and accompany description of its applications. American Wheelabrator & Equipment Corp.

COMPRESSORS

155 Compressor Service Bulletin—Maintenance of double-acting air cylinders is covered in Service Bulletin No. 12. It tells briefly what regular maintenance should include, what repairs may be expected after long service and replacement of parts. A 1-p leaflet, it's punched for permanent use in binder. Joy Mfg. Co.

156 Compressor Leaflet—Single and two-stage, 30 hp direct-connected compressors for multi-fuel operation are described and illustrated in Bulletin F-2000, 2 pp. It tells construction features and includes dimensional drawings and specifications. White-Roth Machine Corp.

157 Air Compressor Lubrication Manual—Valuable information on air compressor maintenance is contained in this 40-pp book on the lubrication of air compressors. Subjects treated include compressed air, compressors and related equipment, lubricating systems, compressor oils and their applications, lubrication requirements, operating hints, oil requirements, storage and care of compressor oils, and safety precautions. All discussions are illustrated with large, clear photographs and drawings showing construction and operation of compressors, their lubricating systems, etc. Cities Service Oil Co. (In the South, Arkansas Fuel Oil Co.)

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1. Bubbler design gives maximum sanitary protection. 2. Smart, streamlined styling blends harmoniously into all surroundings. 3. Effortless finger-tip pressure produces a steady stream of perfect-temperature drinking water. 4. No spouting, no splashing, no annoying fluctuations in water flow.

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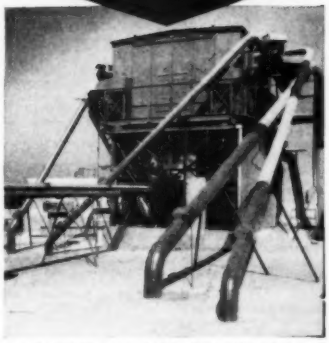

Sly Dust Filter on roof of the Quaker Oats plant at Akron, Ohio. Pipes shown carry dust-laden air from grinding apparatus to filter.

10 MILLION BREAKFASTS PER DAY!

That's the oatmeal output at the Akron Quaker Oats factory. Plus hundreds of tons of poultry and livestock feed a day, in addition to thousands of cases of puffed wheat, rice, hominy grits and Aunt Jemima pancake flour.

Dust from this gigantic operation created a nuisance to workers and plant neighbors. Then SLY engineers were asked to take over.

Through the installation of a 27,000 cfm Sly Dust Control System, all of the fine cereal dust is now collected by filtration through cloth. The entire unit is automatic in operation. An electric timer operates cleaning devices, which periodically shake the dust off the filter bags into hoppers, from which it is conveyed to a point of disposal. The system operates continuously.

The Quaker Oats project is typical of thousands of successful, inexpensive SLY installations which prolong the life of machinery, reduce cleaning and maintenance costs, and eliminate health hazards. *Ask for Bulletin 98 and tell us your problem so that we can write you fully.*

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MISCELLANEOUS

158 Rotating Storage Cabinets — Plant engineers interested in making the most of available storage space will be interested in Catalog No. 106-A, 16 pp, which describes and illustrates rotating steel bins for storing small parts. This book is filled with photos showing various models and their applications, accessories and related equipment. Tells how these storage bins save space and save steps and keep parts within ready access of user. The Frick-Gallagher Mfg. Co.

159 Steam Trap Catalog — Thermostatic steam traps for high pressure industrial service are covered in manufacturer's revised Bulletin 250A, 8 pp. Contains general discussion on these traps, how they're made and how they operate. Includes dimensions, specifications and capacities of traps listed, also prices. Cut-away photos show construction details and sketches show hook-ups. Sarco Co., Inc.

160 Current Measuring Device—This bulletin (6 pp) describes and illustrates a portable test ammeter which works like a pair of tongs and instantly measures both alternating and direct current. Describes instrument's many advantages including ease and speed of use, elimination of shut-down during testing and use without other instruments. Photos show "Tong-Test" in use and available models. Bulletin also gives ranges and tells how to select proper size and type. Also describes and illustrates carrying case and voltage attachment. Lists prices. Columbia Electric Mfg. Co.

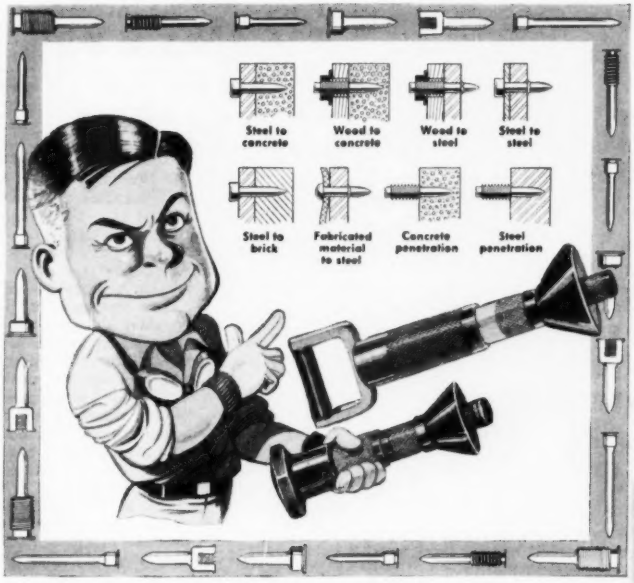
161 Solenoid Valve Catalog — Solenoid valves for automatic and remote control of the flow of liquids and gases are described and illustrated in Condensed Catalog No. 200-R, 12 pp. It covers manually reset safety shut off and trip valves; electrically operated shut off valves, both packed and packless; pilot valves; explosion-proof valves; special valves; and filters and strainers. All types are illustrated with photos. Sizes are given and applications discussed in detail. Includes photos of typical installations. Automatic Switch Co.

162 Refrigeration Condenser Catalog — Designated as Bulletin RC-1, this 24-pp illustrated catalog covers ammonia and freon refrigeration condensers of horizontal and vertical construction. Includes specifications, dimensions and applications according to type. Lists weight and prices of available models and includes property tables for refrigerants and safe external working pressures for steel tubes. Sketches and line drawings show construction details and arrangement of units; photos show many installations. Henry Vogt Machine Co.

163 Pipe Unit Bulletin—Cast-iron insulated pipe units for protection of underground insulated piping are described and illustrated in Form 4810, 1 p. Tells construction, available sizes and lengths, specifications and industrial applications and advantages of these units. The Ric-Wil Co.

164 Silicone Bulletin—A pictorial introduction to the complexities of Silicone manufacture is provided in 12-pp Bulletin CDC-102. It includes brief descriptions of the outstanding characteristics and principal uses of manufacturer's Silicone resins, oils, greases, rubber, and water repellents, and summarizes the steps by which these five classes of products are made. Chemical Dept., General Electric Co.

165 Dry Grinding Data—Described as a "textbook on conical mills," this new 36-pp Bulletin No. 17-B contains a general discussion of dry grinding, tips for improving mill performance and operational data from many specific installations. Includes complete construction details and specifications for mills, air classification systems, regulating feeders, control cabinets and small packaged grinding system. Illustrations include photographs of complete mill assemblies and parts and typical installations, and drawings showing construction, principles of operation and dry grinding layouts. Hardinge Co., Inc.



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Fastening jobs like those illustrated are all in a day's work for JOE RAMSETTER. With his light, self-powered RAMSET TOOL, and 63 sizes of pins and studs, he can set up to 50 fasteners per hour, to cut costs and finish the job faster.

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For your safety campaign against dust hazards, Hoffman vacuum cleaning equipment is built for continuous heavy duty service. Sturdy construction and efficient design assure fast, thorough cleaning at low cost.

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Higher vacuum and greater dust capacity in Hoffman equipment. You can do more cleaning for longer periods. Exclusive features for disposal of collected dust speed up cleaning operations.

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CANADIAN PLANT: NEWMARKET, ONT.

Of Course, M H is Plant Engineering's Job

(Continued from page 31)

built by the same company, were three 10-ft sections of single-tier gravity roller conveyor and four 10-ft sections of double-tier gravity roller conveyor.

All assembly positions are arranged on one side of the conveyor with one packing station and the servicing of parts to hoppers on the other side. This arrangement eliminates unnecessary delay while the positions are being serviced.

There are eight operator positions on the line, including the packing portions. Only four of these are used at any one time. While four of them are being worked the other four are being serviced and readied to operate for a quick changeover at the end of a run.

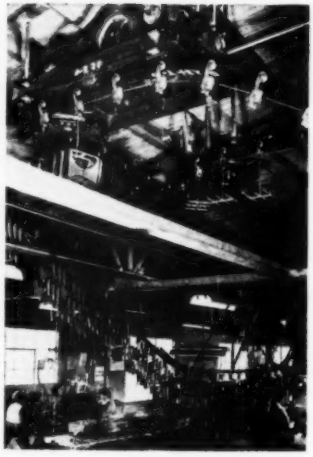
Each operator has approximately 4 ft of working space. Within this space all parts are positioned for an easy reach-or-grasp operation. Large parts such as plane beds or frog subassemblies are fed to the operator under the Unitized Table via the top tier of the gravity roller conveyor. The empty tote boxes are returned to the service man via the lower tier. The service man, as mentioned above, does not have to interfere with assembly operations. The assembly unit is located on the west wall side of the department (see drawing) while the storage banks of parts are located, conveniently for the service man, on the east side of the department.

The entire arrangement allows eleven different models of planes to be assembled on the one conveyor. The only change necessary is an occasional change of belt speed. Only one model is assembled at any one time but parts for any one of the other ten are always ready at the other four stations which are serviced immediately during a changeover. This is a valuable arrangement because it permits immediate revisions of production schedules when unforeseen conditions pop up.

Plane beds are given a last minute cleaning and a rust-preventive bath at a substation located at the head of the line; after treatment the beds are put on the conveyor table for final assembly. Only one other subassembly is performed at a point other than the line. The frog subassembly takes place immediately after the final machining operation.

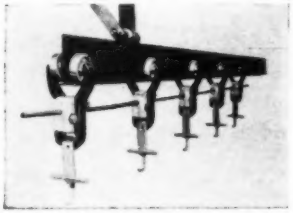
To FACILITATE removal of wheels on overhead cranes when wheel travels on bottom flange of rail, the Glenn L. Martin Co., Baltimore, Md., has openings cut in the web of the rail at the ends of the track. By lifting the weight of the crane off the flange opposite the opening, the wheel may be removed.

...ABOVE ALL Buschman Cable Trolley Conveyors reduce your handling costs



Buschman Cable Trolley Conveyors put your overhead space to work for you . . . reducing overhead . . . bringing costs down. In leading plants these Universal Cable Conveyors have proved to be *the* low-cost, durable and efficient method of handling light to medium loads. Easily installed or altered to meet changing conditions. Write for Bulletin 40.

STANDARD STOCK UNITS
Smooth Running, Trouble-Free Installation



TROLLEYS (Pat. Pending). Have split driving lug castings bolted to all steel cable, with channel brackets and ball bearing wheels. TROLLEYS rated up to 160-lb. capacity spaced on 12" centers. Track 3" T. JR. with hanger lugs for bolted supports, dowel pinned joint.

THE E. W. BUSCHMAN CO., INC.
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Buschman Conveyors

To—
SIMPLIFY
Temperature Control

Install POWERS No. 11 Self-Operating INDICATING REGULATORS

Reduce costs and get a better, more uniform product with the constant temperature maintained by this popular Powers Regulator. An easy to read 4" dial thermometer indicates temperature of process or operation under control. Prevents losses caused by OVER-heating. Saves steam and labor.

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WRITE FOR BULLETIN 329

POWERS No. 11
TEMPERATURE INDICATING REGULATOR
Simple • Dependable • Economical

TRICO *Powder-Packed*

RENEWABLE FUSES
Give You:
√ BETTER PERFORMANCE!
√ SAFER PERFORMANCE!
√ LOWER FUSE COSTS!

Here's Why: ←

- **"POWDER-PACKING"** protects link against bending, twisting, fractures and gives support against sagging, thinning out . . . RESULT: Less fuse blowings.
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- **"POWDER-PACKING"** acts as a heat insulator, absorbs heat and provides an effective barrier or baffle. RESULT: TRICO fuses operate cooler and GIVE THREE TIMES THE SERVICE.
- **"POWDER-PACKING"** creates emergency time-lag against sudden or surge overloads. RESULT: Less fuse blowings.

• "POWDER-PACKING"
Prevents tampering and link interchanging. Only TRICO custom-built element can be inserted. RESULT: no doubling-up dangers . . . no mistakes . . . no needless blowings.

WRITE FOR FREE BOOKLET 206-A

TRICO Safety FUSE PULLERS
Provide cheap insurance against accidents of burns, shock, infection, etc., when changing fuses, adjusting fuse clips or making other electrical repairs.
WRITE FOR BUL. NO. 5

TRICO FUSE MFG. CO. Milwaukee, Wis.

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GARLOCK 7021 Compressed Asbestos Sheet Packing. Gaskets, styled GARLOCK 7022 in all sizes and shapes.

GARLOCK 7021 is a strong, dense, compressed asbestos sheet. This gasketing material is sufficiently compressible to compensate for normal irregularities in flange faces, but resistant to plastic flow under heavy bolt loads. Withstands extreme pressures and high temperatures. Specially recommended for severe oil and steam service.

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7021
COMPRESSED ASBESTOS
GASKET SHEET

Brawny ELECTRIC TRUCK *AMAZES* MANAGEMENT

Cuts Handling Costs *IN HALF!*

Works All Day for 11¢*

Imagine, if you can, a brawny electric truck that moves and lifts 6000 pounds of your product so simply and easily, even your stenographer could operate it all day, and never become the *slightest bit fatigued!*

That miracle truck is Automatic Transporter. It moves and lifts *any and every* kind of product with amazing touch-of-thumb ease. All operator does is *press the button. Transporter does the rest!* One man handles more material than three men *manually* . . . enjoys doing it!

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Send free catalog showing Transporter new, low-cost way to cut handling costs in half.

Name.....

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Heat Exchanger Costs Selection, Maintenance

(Continued from page 30)

ature ranges for liquid-to-liquid heat exchangers.

Figure 4 shows an internal floating head type unit. No split ring is used and the head is bolted directly to the tube sheet. The space taken by the bolting leaves an annulus around the bundle which is of considerable value in condensing vapor since it allows distribution and penetration of the vapor around and between the tubes. It is for this reason that this type of exchanger is used so widely in power plant feed water heaters. They can be built in multi-tube pass arrangements over wide temperature ranges and for high pressures.

Figure 5 illustrates a very common type of removable bundle unit used for engine jacket water, lube oil, reduction gear oil, quench oil, fresh water coolers, etc. This type of construction is limited to units of one or two tube passes, and a single shell pass, for low operating pressures and medium temperature ranges for liquid-to-liquid exchangers. They are not recommended for large shell diameter units. The construction is less costly but has all the advantages of the full floating head subject to the limitations mentioned.

For Larger Diameters

Figure 6 shows the construction of an externally packed unit which can be used for multi-pass exchangers of large diameter. Much higher shell side pressures can be used in this type than in the unit illustrated in Fig. 5. In liquid-to-liquid work, the annular space due to floating heat bolting is often troublesome, especially in smaller diameter units.

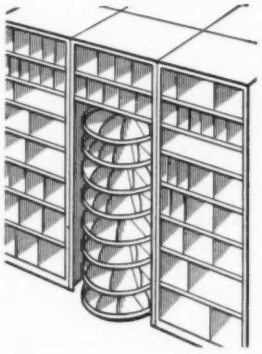
Figure 7 shows the U-tube type used extensively as small feed water heaters and liquid-to-liquid exchangers where the tube side fluid is entirely nonfouling. It is available in multi-pass design, can be used over wide temperature ranges, for high pressures and is the cheapest of all removable bundle designs.

In large units, such as central station power plant high pressure feedwater heaters, the bends are made using tubes having the section at the bend of heavier gage than the straight portions so that when the tube wall thins out during bending, the minimum required wall thickness will exist throughout the entire tube length. This type of unit with an open end shell is also used, with steam or hot water in the tubes, as oil storage tank suction heaters, storage water heaters and similar applications.

Figure 8 shows the simplest and cheapest arrangement of the fixed

ROTABINS . . .

Increase Storage Space Up to 50%. Provide More Profitable Operation



Miles of steps are eliminated, time and space are saved by using Rotabins. Simply turning the tray brings many feet of shelving and many compartments to one point. This easy accessibility to stock arrangement is the key to efficient parts handling.

Rotabins are particularly advantageous when used in corner locations. Large areas with relatively small aisle frontage are now effectively utilized. Every square foot has a front position when needed. Trays rotate easily on ball-thrust bearings; will not sag or break when fully or unequally loaded.

Rotabins are available in a wide variety of standard sizes from 12 to 72 inches in diameter and from 6 to 96 inches high. Trays rotate around a heavy tubular steel stem secured to a solid circular metal base. Rotabins are durable, portable; require no bracing or fastening. Standard finish is olive green enamel, baked-on.

You can make full use of various drawer and tray arrangements in combination with straight shelving, counters and tables. Savings realized can quickly pay for entire investment. Let F-G-M engineers plan and recommend most profitable layout for your requirements. Write, 'phone or wire today.

Send for Catalog 106-A

THE FRICK-GALLAGHER MFG. CO.

Shelving—Parts Bins—Racks
Counters—Tables—Benches

410 Shubert Building, Phila. 2, Pa.

"LIQUIDS WORTH STORING ARE WORTH MEASURING"

with a

LIQUIDOMETER

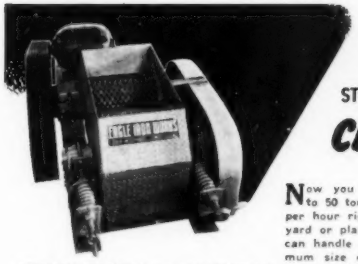
Tank Gauge

- FOR GAUGING LIQUIDS OF ALL KINDS
- 100% AUTOMATIC
- APPROVED BY UNDERWRITERS' LABORATORIES

WRITE FOR COMPLETE DETAILS

THE LIQUIDOMETER CORP.
36-31 SKILLMAN AVE., LONG ISLAND CITY, L.I., N.Y.

NOW! •HANDLE GREATER TONNAGE •HANDLE LARGE LUMP COAL



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STOKER COAL

Cracker

Now you can produce 20 to 50 tons of stoker coal per hour right in your own yard or plant . . . now you can handle up to 10" maximum size coal. This Eagle "Cracker" is a brand new unit designed to meet your demand for greater tonnage and lump capacity than the famous Eagle "Chipper."

The model shown has an integrally mounted motor with V-belt tension adjustment. Also available without motor and drive. Wheel mounted for portability available. Two gearings permit two reduction ranges: 3/8" to 1 3/8" through roll-spacing adjustment in one range; 1 3/8" to 2 3/4" in the other range. Requires only 10 to 15 H. P.

Semi-steel crusher rolls with chilled teeth protected by automatic spring release for passing damaging scrap, etc. Large easy-loading steel hopper, welded steel base, rugged self-aligning bearings, safety steel gear guard. Write for details.

Olson Self-Dumping Mine Cages and Stoker Coal Crushers

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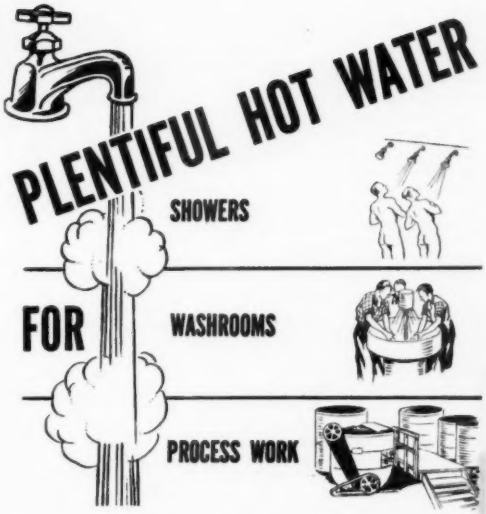

TACO WATER HEATERS USE LIVE STEAM, CONDENSATE, OR BOILER WATER

▶ **SMALL SPACE REQUIRED**

▶ **LOCATE AT POINT OF USE....**
Save all that piping back and forth to central boiler room.

▶ **STEAM CONSUMED ONLY DURING A FEW HOURS A DAY WHEN WASHROOM IS USED**

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Taco

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SEND ME YOUR CATALOG ON TACO WATER HEATERS

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I would like your help on a hot water problem I have at the present time

tube sheet types. It is used successfully where the shell side fluid is nonfouling and over small temperature difference ranges. For larger temperature differences, the shell can be fitted with a bellows type expansion joint, as in Fig. 9.

Where temperature difference ranges are large and the tube side is multi-pass, the arrangement, shown by Fig. 10 with a floating tube sheet, can be furnished. Where the tube side fluid is corrosive, the heads and sheets can be clad with corrosion resistant material. Separate tube sheets, bolted to shell flanges, can also be furnished as in Fig. 11.

Fixed tube sheet units with tubes rolled at the inlet end and packed at the outlet end can also be used for multi-pass liquid-to-liquid exchangers or liquid-to-cool condensing vapors as in small steam condensers operating under vacuum. A standard type of fibre-metallic packing is shown by Fig. 12.

It is obvious from the foregoing that no clear cut separation exists among the various types of exchangers. A proper choice can therefore be made only after a careful analysis of all factors involved. To ensure that the best and most economical equipment will be chosen, it is essential that close cooperation exists between the purchaser and the designer.

Plant Engineer's Library

What's in The Air?*

GAS TABLES by Joseph H. Keenan and Joseph Kaye. Size 7x10 in., 238 pp; cloth bound. Published by John Wiley & Sons, Inc. Price $5.50.

THESE GAS TABLES covering Thermodynamic Properties of Air, Products of Combustion, Component Gases and Compressible Flow Functions (including those of Ascher H. Shapiro and Gilbert H. Edelman) supersede the previous book entitled Thermodynamic Properties of Air by Professors Keenan and Kaye. The properties of air have been re-examined and recalculated. The properties of combustion products of hydrocarbons and of the constituent gases have been added.

The book includes 64 tables showing various functions of air, products of combustion, oxygen, water vapor, carbon dioxide, and other gases, giving values for enthalpy, entropy, specific heats, ratios of specific heats, and many other functions needed in the calculations.

For anybody who must work either as a designer or as a practicing engineer in the field of air and gas compression and expansion and allied problems, this new book will be found as indispensable as steam tables for the steam engineer.

And, Mechanical Men*

PRINCIPLES OF SERVOMECHANISMS by Gordon S. Brown and Donald F. Campbell. Size 6x9½ in.; 400 pp; illustrated; cloth bound. Published by John Wiley & Son, Inc. Price $5.00.

AS APPLICATIONS of control systems have been increased in number, the demands imposed on their reliability, precision, and speed of operation, have also increased. The result of this has been that the design of several mechanisms and automatic regulating systems has now become a science in itself.

This book is a treatment of that science to bring out the fundamental principles involved in the functioning of automatic control systems and an accurate knowledge of the properties of the mechanisms of which it is composed. After explaining the elements and components, the book continues with a discussion of dy-

(Continued on page 70)

An asterisk (*) following the title of any book described in this department indicates that the book may be purchased from the Book Department, PLANT ENGINEERING, 53 W. Jackson Blvd., Chicago 4, Ill.

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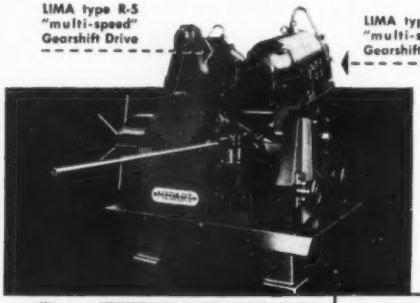

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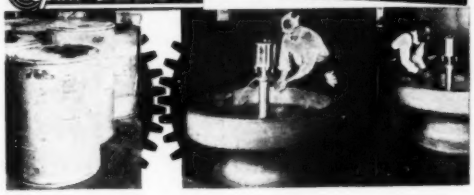

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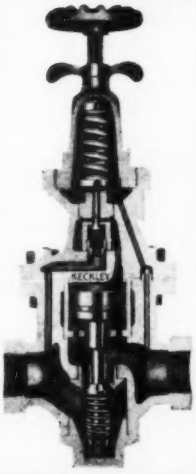

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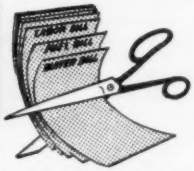

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Considerable mathematical knowledge is required for understanding the text and solving the problems.

Stop That Smoking!

SMOKE PREVENTION ASSOCIATION PROCEEDINGS. Size 8½x11 in.; 190 pp; illustrated; paper bound. Published by John Paul Taylor, 520 Pleasant St., St. Joseph, Mich. Price $2.00.

ALL THE PAPERS (15) presented at the 1948 meeting of the Smoke Prevention Association of America, Inc., have been assembled in this book. They range from a discussion of what industry is doing about Pittsburgh smoke to practical suggestions on operation to keep fuel burning equipment smoke free. Two methods of wet scrubbing of gases for reduction of atmospheric pollution are included. Other papers discuss marine practice in oil burning; what industry is doing about Pittsburgh's smoke; dust fall studies; and, elimination of flue dust from stoker fired boilers.

An asterisk (*) following the title of any book described in this department indicates that the book may be purchased from the Book Department, PLANT ENGINEERING, 53 W. Jackson Blvd., Chicago 4, Ill.

Text Book on Engines*

COMBUSTION ENGINES by Arthur F. Fraas. Size 6x9 in.; 440 pp; 245 illustrations and tables; cloth bound. Published by McGraw-Hill Co., Inc. Price $5.50.

DESIGNED primarily for engineering college seniors and young engineers in the industry, this book approaches the subject by developing the ideal relationships from elementary theory, and then shows how these are related to methods for solving practical engineering problems. Familiarity with college chemistry, physics, thermodynamics, and fluid mechanics, is essential to a full understanding of the text.

The book begins with a discussion of engine types and construction, then treats idealized cycles, thermodynamic-calculation methods for combustion-engine cycles; combustion, and cycle analysis. Following this are chapters on fuel metering and injection; ignition; fuels and lubricants; intake and exhaust manifolds; lubrication, cooling; supercharging; performance analysis. There is a good chapter on the gas turbine, and the book concludes with discussion of engine installations and overhaul and maintenance.

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(Continued on page 74)

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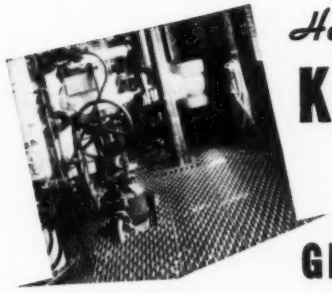

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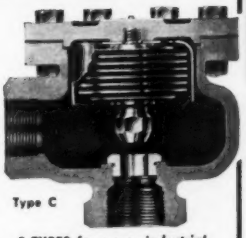
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ADVERTISER'S INDEX

Adam Cook's Sons, Inc. 60
American Monorail Co., The 9
Agency—The Bayless-Kerr Company
Anderson Co., The V. D. 58
Agency—Will, Inc.
Armstrong Machine Works 3
Agency—Russell T Gray, Inc.
Audel Publishers ..... *
Agency—Grant & Wadsworth, Inc.
Automatic Transportation Co. 66
Agency—Ruthrauff & Ryan, Inc., Advertising
Beaver Pipe Tools, Inc. ..... Inside Front Cover
Agency—Meek and Thomas, Inc.
Biddle Co., James G. 49
Agency—The Harris D. McKinney Organization
Bradley Washfountain Co. 54
Agency—Kirkgasser-Drew
Brady Co., W. H. ..... *
Agency—Richard H. Brady Co., Inc.
Bulldog Electric Products Co. ..... *
Agency—Brooke, Smith, French & Dorrance, Inc.
Burgess-Manning Co. 74
Agency—The Fensholt Co.
Buschman Co., Inc., The E. W 64
Agency—The S. C. Baer Co.
Cash Company, A. W. ..... *
Chelsea Fan & Blower Co., Inc. ..... *
Agency—George Homer Martin Associates
Chicago Metal Hose Corporation ..... *
Agency—Russell T. Gray, Inc.
Crocker-Wheeler Elec. Mfg. Co. ..... *
Agency—Horton-Noyes Co.
Darling Valve & Manufacturing Co. 21
Agency—The Griswold-Eshleman Co.
Dart Mfg. Co., E. M. ..... *
Agency—Sutherland-Abbott
Deming Co., The 61
Agency—G. M. Basford Co.
Dodge Mfg. Corp. ..... *
Agency—Lamport, Fox, Prell & Dolk, Inc.
Eagle Iron Works 67
Agency—Tri-State Advertising Co.
Economy Engineering Co. ..... *
Agency—Kreicker & Meloan, Inc.
Edmont Mfg. Co. ..... *
Agency—Mumm, Mullay & Nichols, Inc.
Federal Enterprises, Inc. 70
Agency—Calkins & Holden
Felters Company, The 59
Agency—Sutherland-Abbott
Ferranti Electric, Inc. ..... *
Agency—Rose-Martin, Inc.
Flexrock Company 69
Agency—Walter S. Chittick Company
Frick-Gallager Mfg. Co., The 66
Agency—John P. Eldridge
Garlock Packing Co., The 65
Agency—Hutchins Adv. Co., Inc.
Gates Rubber Co., The 17
Agency—Cloyd F. Woolley, Inc.
General Electric Company 14-15, 25
Agency—G. M. Basford Co.
General Electric Company, Construction Materials Dep't. ..... *
Agency—G. M. Basford Co.
Goodall Rubber Co. 56
Agency—George C. Taylor
Goodrich Co., The B. F. 5
Agency—The Griswold-Eshleman Co.
Great Lakes Steel Corp. ..... *
Agency—Campbell-Ewald Co.
Greene, Tweed & Co. ..... *
Agency—RAF Advertising, Inc.
Grinnell Company, Inc. ..... Back Cover
Agency—Horton-Noyes Co.
Hicks & Son, Inc., L. E. 68
Agency—Tri-State Advertising Co.
International Nickel Co., Inc., The 53
Agency—Marschalk & Pratt Co.
Island Equipment Corp. ..... *
Agency—Givaudan Advertising, Inc.
Jeffrey Mfg. Co., The ..... *
Agency—Byer & Bowman Adv. Agency
Jenkins Bros. 11
Agency—Horton-Noyes Co.
Joy Mfg. Co. ..... *
Agency—Walker & Downing
Keckley Co., O. C. 69
Agency—Brandt Advertising Co.

Kelso-Burnett Electric Co. ..... *
Kinnear Mfg. Co., The ..... *
Agency—Wheeler-Knight & Gainey, Inc.
Kirk & Blum Mfg. Co., The ..... Inside Back Cover
Agency—The S. C. Baer Company
Klemp Co., Wm. F. 71
Agency—Symonds, MacKenzie & Co., Inc.
Korfund Company, Inc., The 73
Agency—Sanger-Funnell, Inc.
Lima Electric Motor Co., The 68
Agency—Central Advertising Agency
Liquidometer Corp., The 67
Agency—Lucerna Co., Inc.
Mercoid Corporation, The 73
Metallizing Engineering Co., The ..... *
Agency—The Schuyler Hopper Co.
Mortell Co., J. W. 70
Agency—Weston-Barnett, Inc.
Multifinish Mfg. Co. ..... *
Agency—Alfred B. Caldwell, Inc.
Niagara Blower Company ..... *
Agency—The Moss-Chase Co.
Nicholson & Co. W. H. 71
Agency—Wilbur A. Myers
Nugent & Co., Inc., Wm. W. 52
Agency—Russell T. Gray, Inc.
Powers Regulator Co., The 65
Agency—Symonds, MacKenzie & Co., Inc.
Prat-Daniel Corp. 60
Agency—The Harry P. Bridge Co.
Robbins & Myers, Inc. 13
Agency—Erwin, Wasey & Co., Ltd.
Robertson Co., H. H. ..... *
Agency—Fuller & Smith & Ross, Inc.
Roth Company, Roy E. 71
Agency—Almon Brooks Wilder, Inc.
Sarco Company, Inc. 23
Agency—W. L. Towne Advertising
Schmieg Industries, Inc. ..... *
Agency—Alfred B. Caldwell, Inc.
Sexauer Mfg. Co., Inc., J. A. 69
Agency—Reiss Advertising
Sly Mfg. Co., The W. W. 62
Agency—The Bayless-Kerr Co.
Smooth-On Mfg. Co. 69
Agency—Michel-Cather, Inc.
Snap-On Mfg Co. 57
Agency—Scott, Inc.
Spartan Tool Co. 71
Agency—Turner Advertising Agency
Speer Carbon Company ..... *
Agency—Tyson & Company, Inc., O. S.
Spencer Turbine Co., The ..... *
Agency—W. L. Towne Advertising
Star Fuse Corp. ..... *
Stemco Corporation 63
Agency—Fuller & Smith & Ross, Inc.
Sticht Co., Inc., Herman H. 74
Agency—Gallard Advertising Agency, Inc.
Stonhard Company 72
Superior Combustion Industries, Inc. ..... *
Agency—Charles H. Davis
Taco Heaters, Inc. 67
Agency—Tyler Advertising Agency
Temprite Products Corp. 62
Agency—Martin Hahn Advertising
Towmotor Corporation ..... *
Agency—Howard Swink Advertising Agency, Inc.
Trico Fuse Mfg. Co. 65
Agency—Andrews Agency, Inc.
Trimont Manufacturing Company ..... *
Agency—Horton-Noyes Company
Troy Engine & Machine Company ..... *
Agency—Sanger-Funnell, Inc.
Trumbull Electric Mfg. Co. 55
Agency—James Thomas Chirurg Co.
U. S. Hoffman Machinery Corporation 64
Waldron Corp., John ..... *
Agency—Alexander Ross Agency
Wayne Pump Co., The 50
Agency—Bonsib Advertising Agency
Westinghouse Electric Corporation 6-7, 18, 46-47
Agency—Fuller & Smith & Ross, Inc.
Worthington Pump & Machy. Corp. ..... *
Agency—James Thomas Chirurg Co.
Yarnall-Waring Company 26
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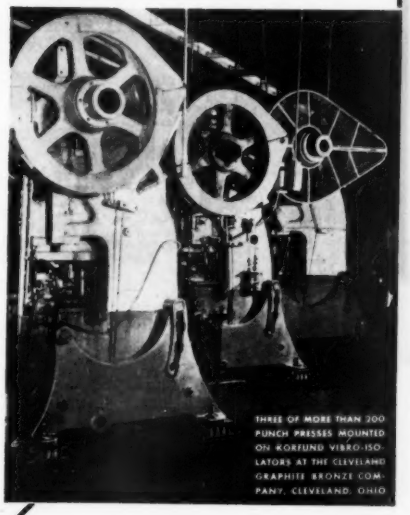

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STANDARDS OF HYDRAULIC INSTITUTE. Size 8½x11 in.; eighth edition; 250 pp; illustrated loose leaf paper bound. Published by the Hydraulic Institute, 90 West Street, New York 6, New York. Price $3.00.

THE HYDRAULIC INSTITUTE is a trade association consisting of the principal manufacturers of displacement and centrifugal pumps in the United States. This eighth edition of its famous book of standards gives the latest technical and engineering data on pumps and piping and should be in the hands of every plant engineer.

The material covers good engineering practice in the pump industry. It is divided into several sections which may be removed if desired for convenience in handling. The first section covers centrifugal pumps, including definitions of types and parts, curves of net positive suction head, instructions for installations, data on applications, and a complete test code. The next two sections cover rotary pumps and reciprocating pumps and follow in general the same organization.

A data section covers such things as friction of paper stock in cast iron pipe; materials for pumping various liquids; and data required by pump manufacturers for proper selection of material. The final and largest section in the book gives data tables and examples in their use in problems involving: friction losses for pipe, valves and fittings; the effect of viscocity; viscosity of common liquids; properties of steel and wrought iron pipe; and, many other data.

For Those Who Meter

DIFFERENTIAL FLUID METERS by E. Curtis Richard. Size 6x9 in.; first edition; 117 pp; illustrated; cloth bound. Published by The Brown Instrument Co., Philadelphia 44, Pa. Price $2.00.

THIS BOOK is based on experience gained from 12 yr of training application and service engineers in The Brown Instrument Co. Service Training School. The material is a condensation of that used by instructors to give students, knowing little about the metering field, a firm basis on which to build. It was not intended to be exhaustive or cover the highly refined developments met with in application of meters to many industrial processes.

Section I covers principles of operation of the differential head flow meter and Section II explains primary measuring devices such as the Venturi tube, the flow nozzle, and the orifice plate. Section III covers secondary measuring devices including those used by all the principle manufacturers of flow meters.

Other sections cover: telemetering, i.e., transmitting meter readings to a distance; the Brown ratio controller for maintaining one variable at a predetermined ratio; integrators and their mechanisms; flow meter installations and operation; preparing a flow meter for operation; details of calibration; and flow approximation tables.

Data on Diesel Operation

REPORT ON OIL ENGINE POWER COST FOR 1947. Size 8½x11 in.; 40 pp; paper bound. Published by The American Society of Mechanical Engineers, 29 West 39th Street, New York 18, New York.

THIS is the latest report on oil engine power costs issued annually by the ASME. It gives information on performance and production costs from 117 oil-engine generating plants containing 396 engines, totaling 341,114 rated bhp. Table I gives detailed information on production costs for the plants reporting; Table II gives comparative costs from 1929 to 1947; and Table III shows engine details and operating information.

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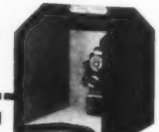

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